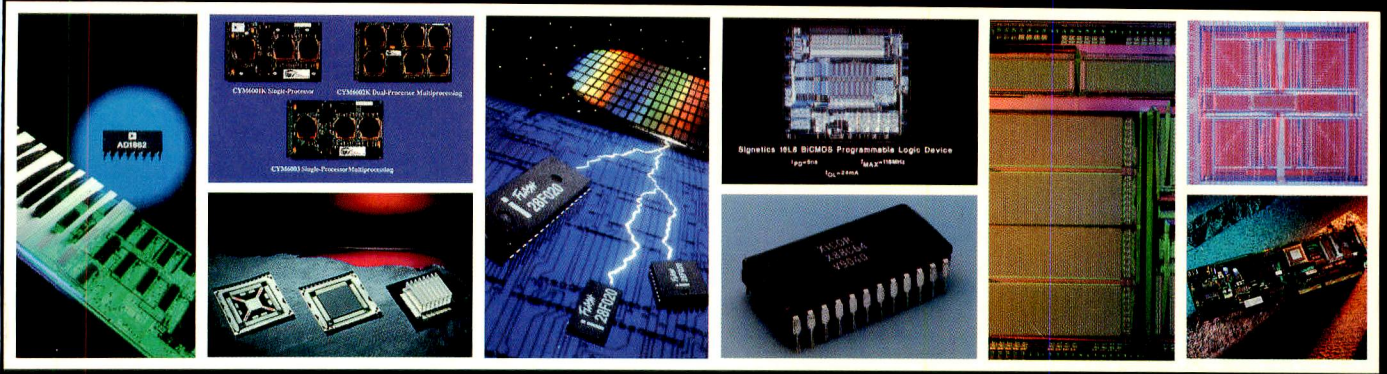
1992
IC MASTER



3. Advertisers Technical Data

- Manufacturers and Distributors Directory
- Advertisers Data Pages

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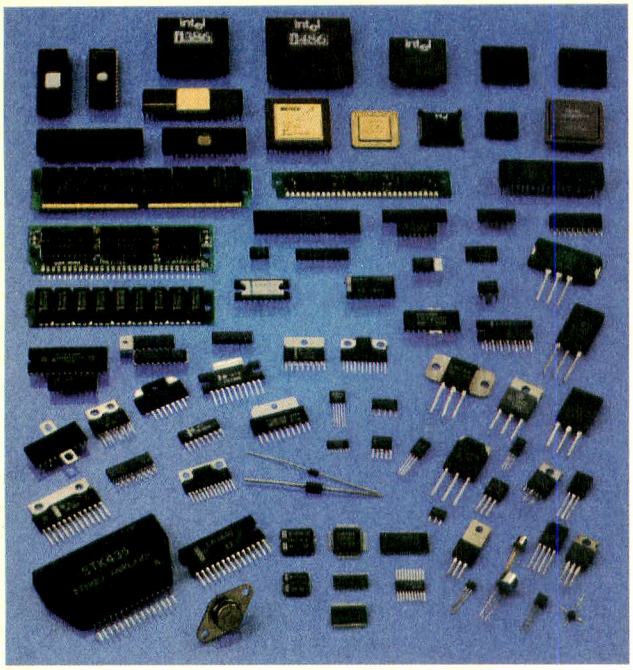

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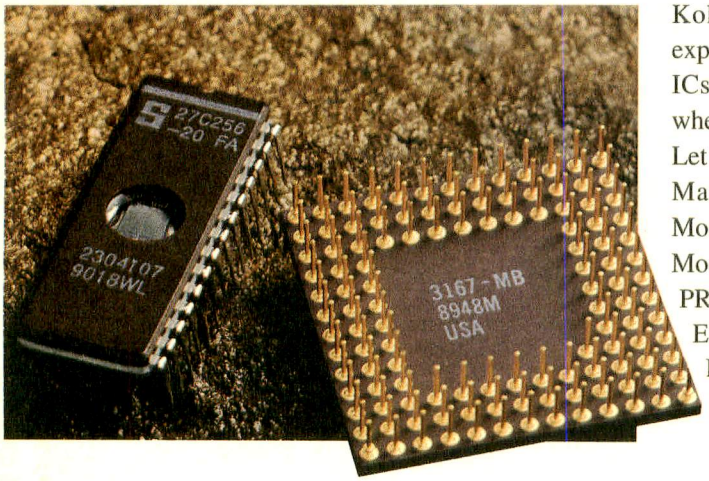

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Volume 1

Analog Devices ...(Inside Front Cover)
NuHorizons
.....(Opposite Table of Contents)
Contents 1
IC MASTER Staff 2
How to use the IC MASTER 2
Abbrev. of Company Names 6
Editorial Advisory Board 8
Master Selection Guide
Function Index..... 9
Digital Selection Guide 101
Digital Signal Processors 251
Microprocessor Selection
Guide 301
American Arium 450
Microprocessor Development
Systems.....451
Interface Selection Guide 501
Linear Selection Guide..... 701
Dense-Pac Microsystems 900
Memory Selection Guide 901
Stanford Telecom.....1200
ASICs/Custom
Selection Guide.....1201
Data I/O 1300
Programmable Logic Devices ...1301
Chip Sets and Multifunction
Devices 1401
International Distributors
.....(Facing Inside Back Cover)

Volume 2

Hyundai .....(Inside Front Cover)
NuHorizons
.....(Opposite Table of Contents)
Contents 2001
IC MASTER Staff 2002
How to use the IC MASTER ... 2002
Abbrev. of Company Names ... 2006
Editorial Advisory Board 2008
Part Number Guide 2011
Part Number Index 2101
Military Parts Directory 2401
Lansdale Semiconductor 2500
Alternate Source Directory 2501
Application Note Directory 2901

Volume 3

KOH Electronics...(Inside Front Cover)
Contents 3001
IC MASTER Staff 3002
How to use the IC MASTER ... 3002
Abbrev. of Company Names ... 3006
Editorial Advisory Board 3008
Manufacturers and Distributors
Directory 3009
Advertisers Data Pages
Actel 3300
Adaptec..... 3306
Advanced Analog.....3307
Analog Devices 3309
Apex Microtechnology 3377
Array Microsystems.....3382
AT&T 3386
Brooktree 3404
Burr-Brown 3408
Catalyst Semiconductor 3424
Cirrus Logic 3426
Cypress Semiconductor 3430
Dallas Semiconductor.....3439
Datel 3440
Dense-Pac Microsystems 3447
Electronic Designs Inc. 3463
Fujitsu Microelectronics 3467
Gennum Corp. 3493
Gould AMI 3498
Harris Semiconductor.....3505
Hyundai Electronics.....3531
Ideal Semiconductor 3532
Intel 3536
ICT, Inc. 3544
Krueger Company 3548
Lansdale Semiconductor 3549
Lattice Semiconductor 3561
LSI-CSI 3562
LSI Logic 3566
Micrel 3573
Micro-C 3578
Micron Technology 3579
Mitsubishi Electronics 3583
NEC 3589
Newbridge Microsystems 3593
NJR Corp. 3594
NMB Semiconductor 3596
OKI Semiconductor.....3598
Performance Electronic
Packaging 3610
Quality Semiconductor 3611
Rochester Electronics 3615
Rohm 3616
Scorpion Semiconductor 3620
Seiko Instruments 3621
Sharp 3623
Signetics/Phillips 3628
Siliconix 3679
Silicon Systems.....3683
Simtek.....3689
S-MOS 3693
Sony 3694
Stanford Telecom.....3703
Synergy Semiconductor 3705
Teledyne Components 3713
Toshiba America 3718
Universal Semiconductor 3737
Vitelic 3739
VLSI Technology 3741
Waferscale Integration 3750
Western Design Center 3754
Xicor 3755
Xilinx 3785

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ISSN # 0894-6809

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HEARST BUSINESS COMMUNICATIONS, INC.
645 Stewart Avenue
Garden City, NY 11530
Tel: (516) 227-1300, FAX: (516) 227-1901

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HOW TO USE THE IC MASTER

The 1992 edition of the IC MASTER is arranged in three volumes. Each volume serves a specific purpose to help you find the integrated circuit or related product you need. The table of contents on page 1 describes what is in each volume. The table also includes the starting page number for each advertiser.

The IC MASTER is a functional work. You know what you need. The MASTER helps you find it.

Here are typical problems.

Q. What kinds of functions does the MASTER cover?

A. Turn to page 10 in Volume One. Here is a complete list of the devices covered. The page and line numbers refer you to the exact Section in which a particular function appears.

Q. Who makes a 16384 x 1 static RAM with an access time of 70 ns or faster? What are my technology choices?

A. Pick up Volume 1. Turn to the MEMORY section. The first page of the section tells you where the listings of your device begin. See this under:

Static RAMs — General Purpose
Modules
Multiport
NOVRAMs
Cache RAMs

Turn to Static RAMs — General Purpose.

In the first column you see the Organization. Browse through the pages until you reach the 16384 x 1 listings. Now look through the listings until you find the access time and characteristics you need. Device numbers are shown by manufacturer. The device numbers of advertisers in the 1992 IC MASTER appear in bold face. The page number following the device number is where additional information may be found in Volume Three. At the extreme right you will see line numbers. These are the specific lines where a device appears.

Q. Which microprocessors are listed in the MASTER? How do I find the microprocessor I need?

A. All commercially available microprocessors are listed in the MASTER. Start with the **microprocessor** listing in the **Master Selection Guide Function Index** (starts on page 10). Here you will find the various kinds of products you will need listed according to function. Turn to the various pages shown and then to the advertisers' page where more detail may be available.

Q. Who makes a Dual, Low Offset Voltage Op Amp?

A. This is a **LINEAR** device. Turn to the LINEAR section in Volume One. The first page of the section shows the starting page for each type of device. Turn to the page where Dual Units appear. Look down the list for the device you need. Advertisers' devices are listed in bold face. Turn to the page in Volume Two where more information may be available.

Q. I need an IC with Music capability. Which Master Selection Guide should I use?

A. Turn to the **Master Selection Guide Function Index** starting on page 10. Look through the list until you find **Music.** The page numbers for each kind of device are shown.

Q. I plan to use a digital gate array or some other semicustom ASIC in my next project. Where do I find it in the MASTER? Who makes these things?

A. Turn to Volume Two. Turn to the first page of **ASICs/Custom**. Find Gate Arrays and all of the other devices listed here. Now you can find the device you need. After you find the type of device you need, turn to the proper page and find the manufacturer. Advertisers' pages are in Volume Three.

Q. I know the digital IC I need is available. Is it available in a surface mount package?

A. There are two ways to solve this problem. If you know the manufacturer's device number, turn to the Part Number Index in Volume One. Find the basic number and the page number and line where that device is listed in the MASTER. Turn to that page. If the device is available for surface mounting, an open diamond symbol will appear. You can also turn directly to the digital section and turn to the function of the device you want. The symbol will indicate an SMD is available.

Q. I am looking for an application note on a specific device. Where can I find out if one is currently available?

A. Pick up Volume Two. Turn to the Application Note Directory. Here you will find app notes arranged by **function**. Find the function involved and turn to the page where the app note is listed.

Q. We need a device that meets MIL standards. Where do I look in the MASTER?

A. Turn to the MILITARY section in Volume Two. The Military Device Testing table shows which manufacturers do what kinds of MIL work. Followed by the MIL-STD-1562R directories for microcircuits which contains numerous tables relating to various standards of classification. Additional information is often supplied by the advertisers' pages in Volume Three.

Q. I know the basic part number is 2502 and that's all I know. Where do I look?

A. That's easy in the MASTER. Turn to the Part Number Index. All prefixes and suffixes have been stripped away. Turn to the page where 2502 appears. All manufacturers with that kind of number appear in order along with the page and line number where the device is described.

Q. How many manufacturers claim to make a pin-for-pin and function-for-function equivalent to a Motorola MC68000?

A. Turn to the Alternate Source Directory in the back of Volume Two. Turn to Motorola's listings. Those manufacturers who claim to be equivalent are listed in order. If you have an IBM or Compatible computer with a hard drive, you can get the 1992 IC MASTER **Alternate Source Directory** on a disk. The disk is Clipper compiled from dBaseIII+ and is delivered compressed by PKARC. This is the complete list of alternate sources and allows you to add notes such as your own part numbers, prices, sources and the like. Call Hearst (516) 227-1300 and ask for Book Sales for further information.

Q. I looked in the Alternate Source Directory. The part I want an alternate source for isn't listed. Why not?

A. Are you sure you looked through the entire listing for the original manufacturer? Some devices may be listed in odd ways depending on how the MASTER's editors receive the information. Then there is the probability that no other manufacturer makes an exact replacement for your part. It is important for you to understand how the Alternate Source Directory is compiled. Manufacturers supply the information that **their** part is an exact replacement for **another** part. The original manufacturer does **not** tell us his part can be replaced by those listed.

Q. What do the manufacturers' part numbers mean? I have a Signetics N8X02N. What do all the letters and numbers mean?

A. Look in Volume Two for the Part Number Guide. Turn to the Signetics portion. Now you know the **N** prefix means, zero to plus seventy degrees Centigrade. The **N** suffix indicates the package style. The numbers and letters in the middle are the device type. Each manufacturer has a different code system. Understanding the systems is a great help in comparing devices.

Q. I found the device I want in the MASTER. What are the pinouts? Where can I get more details? Where can I get a price? What is the delivery time?

A. You have just defined exactly what the IC MASTER does. The MASTER is a guide to tell you which devices are available on a commercial basis. After you know this, the next step is to contact the manufacturer, a local sales office or a distributor.

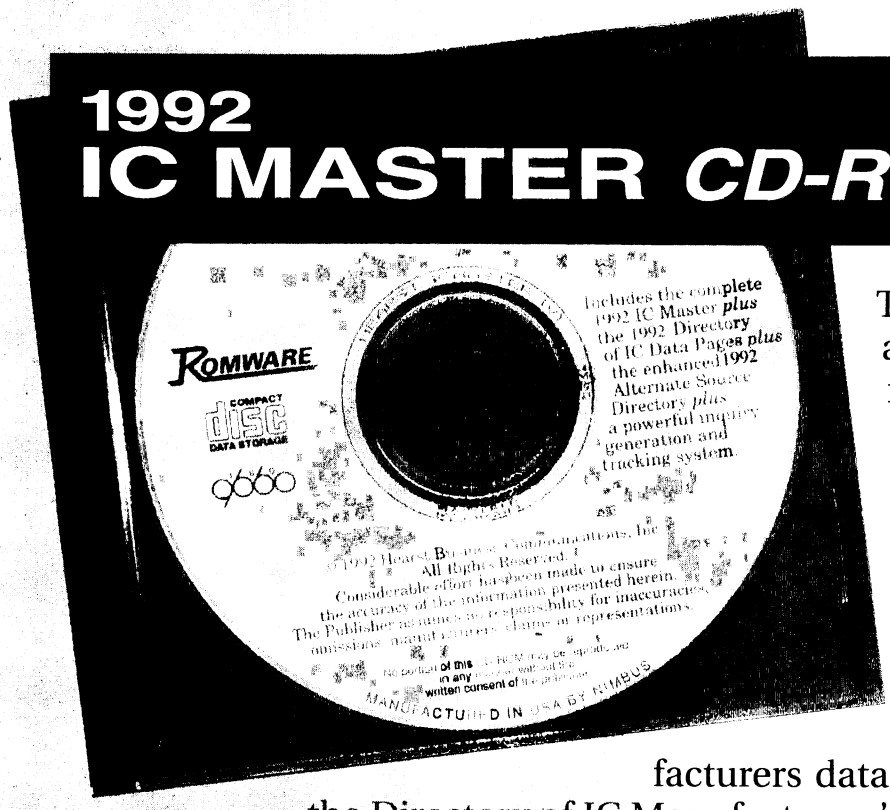
Q. Where can I find the addresses and telephone numbers of manufacturers, local sales offices and distributors?

A. Pick up Volume Three. Turn to the Manufacturers and Distributors Directory. Read the first page. The information on this page will help you understand why the information in the Directory is so important. It will save time and aggravation.

Q. I just saw a new device advertised in Electronic Products magazine. It isn't listed in the MASTER. Why not? When will it be listed?

A. Preparing the information for the annual IC MASTER is a tremendous undertaking. It requires the cooperation of every single manufacturer. All of the material must be organized, cross referenced and placed in the data base. This data base must be closed off in November in order to meet the publishing date of late January. That is why some devices are not listed. They came on the market too late for the deadline. There are two updates to the annual MASTER. They are called the **IC MASTER UPDATE**. One is issued in the late Spring and the other in the early Fall. Be sure to sign up for copies when you get your new IC MASTER. If you are not sure whether or not you have requested the updates, please write to the Circulation Department at the address shown on page 2 of this MASTER. Be sure to indicate which edition of the MASTER you are using.

1992
IC MASTER *CD-ROM PLUS*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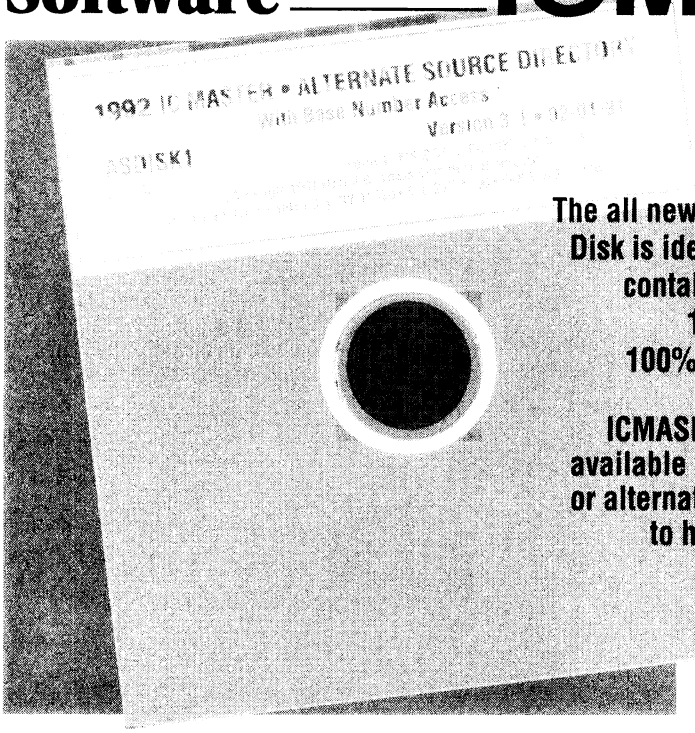
ICMASD *Alternate Source Directory*



The all new 1992 ICMASD-IC Alternate Source Directory on Disk is identical to the Alternate Source Directory Section contained in Volume Two of the printed version of the 1992 IC Master. All you need is an IBM XT/AT or 100% compatible personal computer with hard drive.

ICMASD is the most comprehensive and reliable guide available to all ICs known to have a realistic replacement or alternative. The 1992 version contains 140,000 listings to help you find the correct pin-for-pin replacement parts for both current and discontinued parts.

The electronic ICMASD is fast, convenient...and can be customized for your specific needs!

ENHANCED FLEXIBILITY

ICMASD is organized in a similar fashion to the printed version in the IC MASTER. The database is arranged by manufacturer, showing the manufacturer's original basic part number. All known replacements for that part are listed in alphanumeric order.

The enhanced flexibility of the electronic ICMASD allows you to add comments, up to 20 digits long, to any device listing in the system. These comments can be part numbers, project notes, prices, or any information unique to your application.

USER FRIENDLY

ICMASD is very user friendly. There are no tricky commands to learn. The software is completely menu driven. ICMASD comes complete with documentation that is brief and to the point. It can be ordered on three, double-sided, double-density disks OR on one high-density disk.

FAST AND CONVENIENT

ICMASD includes a complete Manufacturers & Distributors Directory listing the addresses and phone numbers of every manufacturer in the IC industry. With this complete directory any manufacturer or distributor is just a phone call away.

To order your 1992 ICMASD, contact your local IC MASTER distributor.

Or, send your purchase order and check for $179.50 plus tax* to:

Marie Botta
Hearst Business Communications
645 Stewart Avenue
Garden City, NY 11530
(516) 227-1300

*Please add sales tax in NY,MA,IL, CA, or GST tax in Canada
For delivery outside the USA, please add $10 per ICMASD.

ABBREVIATIONS OF COMPANY NAMES

Acculin	Acculin, Inc.
Actel	Actel Corporation
Adaptec	Adaptec
Adv Analog	Advanced Analog
AHA	Advanced Hardware Architectures, Inc.
AdvLinear	Advanced Linear Devices
AMD	Advanced Micro Devices, Inc.
AEG Corp	AEG Corporation-Telefunken
Allegro Micro	Allegro Micro Systems, Inc.
Altera	Altera Corporation
Am Arium	American Arium
AD	Analog Devices
Analog Micros	Analog Microsystems
AnalogSys	Analog Systems
Analogic	Analogic Corporation
Apex	Apex Microtechnology Corporation
AMCC	AMCC (Applied Micro Circuits Corporation)
AppMicroSys	Applied Microsystems Corporation
Aptek	Aptek Microsystems
Array Micro	Array Microsystems
Aspen	Aspen Semiconductor Corp.
Astec Semi	Astec Semiconductor
AT&T	AT&T Microelectronics, 52AL330240
ATMEL	ATMEL Corporation
AutoSys	ASI
Avasem	Avasem Corporation
Benchmarq	Benchmarq Microelectronics
Bipolar	Bipolar Integrated Technology
Brooktree	Brooktree Corporation
Burr-Brown	Burr-Brown Corporation
C&C Tech	C & C Technology Inc.
Catalyst Rsch	Catalyst Research
Catalyst Semi	Catalyst Semiconductor
CE Infosys	CE Infosys of America, Inc.
Cermetek	Cermetek Microelectronics, Inc.
Cherry Semi	Cherry Semiconductor Corporation
Chips&Tech	Chips and Technologies, Incorporated
Cirrus	Cirrus Logic, Inc.
CMD Micro	California Micro Devices Corporation
Comlinear	Comlinear Corporation
Commodore	Commodore Semiconductor Group
Cornes USA	Cornes U.S.A. Ltd.
Crystal	Crystal Semiconductor Corp.
CustomArrays	Custom Arrays Corp.
Cybernetic	Cybernetic Micro Systems
Cypress	Cypress Semiconductor Corp.
Dallas	Dallas Semiconductor
Data I/O	Data I/O Corporation
Datel	Datel, Inc.
Dense-Pac	Dense-Pac Microsystems, Inc.
Dionics	Dionics Inc.
DSP Group	DSP Group, Inc.
ECI Semi	ECI Semiconductor
EdsunLabs	Edsun Laboratories, Inc.
EG&G-Reticon	EG&G Reticon Corporation
Elantec	Elantec, Inc.
EDI	Electronic Designs Inc.
Ericsson	Ericsson Components
Exar	Exar Corporation
EXEL	EXEL Microelectronics, Inc.
Fujitsu	Fujitsu Microelectronics, Inc.
Galil	Galil Motion Control
GEC Plessey	GEC Plessey Semiconductors
Gennum	Gennum Corporation
GET Eng	GET Engineering Corp.
GoldStar	GoldStar Technology, Inc.
Gould AMI	Gould AMI
Greenwich	Greenwich Instruments USA
Harris	Harris Corporation
Headland	Headland
Heurikon	Heurikon Corporation
HP	Hewlett-Packard-Logic Systems Division
HiLevel	Hilevel Technology, Inc.
Hitachi	Hitachi America, Ltd.
Holt	Holt, Integrated Circuits, Inc.
Honeywell	Honeywell
Hughes	Hughes Aircraft Co.
Hyundai	Hyundai Electronics America
IC DESIGNS	IC DESIGNS
IC Sensors	I C Sensors, Inc.
Ideal Semi	Ideal Semiconductor
ILC-DDC	ILC Data Device Corp.
InfoChip Sys	InfoChip Systems, Inc.
Inova	Inova Microelectronics Corp.
IntCirSys	Integrated Circuit Systems, Inc.
IDT	Integrated Device Technology, Inc.
Int Info Tech	Integrated Information Technology, Inc.
ILSI	Integrated Logic Systems Inc.
IntMeasSys	Integrated Measurement Systems
ISSI	Integrated Silicon Solution Inc.
Intel	Intel Corporation
Interface Tech	Interface Technology, Incorporated
Intergraph	Intergraph
ICT	International CMOS Technology
IMI	International Microcircuits, Inc.
IMP	International Microelectronic Products
Interpoint	Interpoint Corporation
Intronics	Intronics, Inc.
IXYS	IXYS Corporation
Krueger	Krueger Company
Lansdale	Lansdale Semiconductor
Lattice	Lattice Semiconductor Corp.
Level One	Level One
Lin Int Sys	Linear Integrated Systems
LinearTech	Linear Technology Corporation
LogicAuto	Logic Automation Incorporated
LogicDev	Logic Devices Inc.
LSTI	Logical Solutions Technology Inc.
LSI Comp	LSI Computer Systems, Inc.
LSI Logic	LSI Logic Corporation
Macrochip	Macrochip Research
Maxim	Maxim Integrated Products
MCE	MCE Semiconductor
Micrel	Micrel

MicroLinear	Micro Linear
MicroNet	Micro Networks Company
MicroPwr	Micro Power Systems, Inc.
Micro-C	Micro-C
Micro-Comp	Micro-Comp Industries
Micro-Rel	Micro-Rel
Microchip	Microchip Technology, Inc.
Microcosm	Microcosm Inc.
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Optimum Semi	Optimum Semiconductor
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Peps	Performance Electronic Packaging Services
Performance	Performance Semiconductor Corp.
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Plus Logic	Plus Logic
PLX Tech	PLX Technology, Inc.
Power Integ	Power Integrations, Inc.
Proxim Inc.	Proxim, Inc.
Proximity	Proximity Technology Inc.
Qualcomm	Qualcomm Incorporated
Quality Semi	Quality Semiconductor
Ramtron	Ramtron Corporation
Raytheon	Raytheon Company
Ricoh	Ricoh Corp.
Rochester	Rochester Electronics Incorporated
Rockwell	Rockwell International
ROHM	ROHM Corporation
S-MOS	S-MOS Systems, Inc.
Samsung	Samsung Semiconductor, Inc.
Sanyo	Sanyo Semiconductor Corporation
Scorpion Tech	Scorpion Technologies, Inc.
SEEQ	SEEQ Technology, Incorporated
Seiko Instr	Seiko Instruments USA, Inc.
Semi-Shield	Semi-Shield
SemTech	Semtech Corpus Christi
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Sharp	Sharp Electronics Corporation
Siemens	Siemens Components, Inc.
Sierra	Sierra Semiconductor Corporation
Signal Proc	Signal Processing Technologies
Signetics	Signetics Company
Sil Composers	Silicon Composers, Inc.
Silicon Conn	Silicon Connections Corp.
SiliconG	Silicon General Semiconductors
SiliconSys	Silicon Systems Inc.
Siliconix	Siliconix Inc.
Simtek	Simtek Corporation
Sipex-HSD	Sipex Corporation
Smart Modular	Smart Modular Technologies
Solarise	Solarise Enterprises Inc.
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Sony	Sony Corporation of America
Sophia	Sophia Systems
SpaceResearch	Space Research Technology, Inc.
Spancom	Spancom Corporation
Stac	Stac Electronics
SMC	Standard Microsystems Corporation
STEL	Stanford Telecommunications Inc.
Startech	StarTech Semiconductor, Inc.
STC	STC Components
Sunshine	Sunshine Semiconductor Inc.
Supertex	Supertex, Inc.
Symphony Lab	Symphony Laboratories
Synergy	Synergy Semiconductor Corporation
Systronix	Systronix. Inc.
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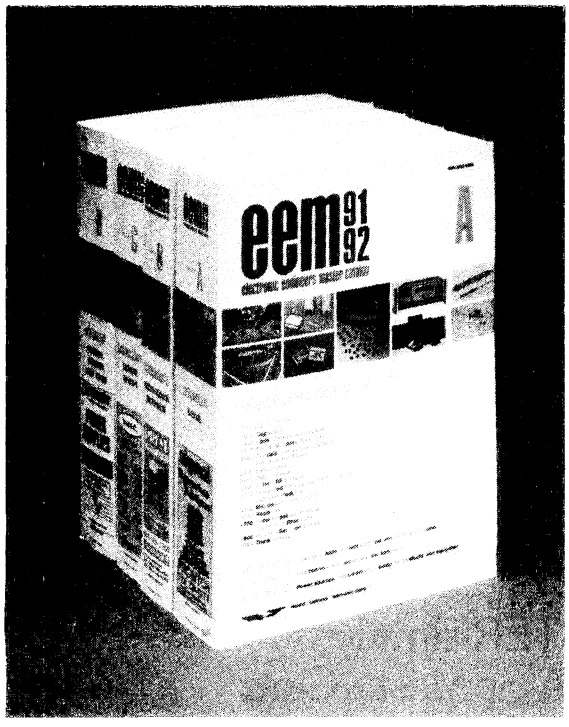

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CT Milford, Milgray 800-922-6911
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GA Norcross, Bell Ind. 404-662-0923
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IL Elk Grove Village, Bell Ind. 708-640-1910
IL Palatine, Milgray 800-322-6271
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IN Indianapolis, Bell Ind. 317-875-8200
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OH Cleveland, Milgray 800-321-0006
OH Dayton, Bell Ind. 513-434-8231
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PR Canovanas, Milgray 809-876-8200

CHERRY SEMICONDUCTOR CORPORATION, 2000 South County Trail, East Greenwich, Rhode Island 02818, Tel: 401-885-3600, TELEX: WUI-6817157, FAX: 401-885-5786

CHIPS AND TECHNOLOGIES, INCORPORATED, 3050 Zanker Road, San Jose, California 95134, Tel: 408-434-0600, TWX: 272929 CHIPS UR

CIRRUS LOGIC, INC., 3100 W. Warren Ave., Fremont, California 94538, Tel: 510-623-8300

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CA Thousand Oaks, Sales Office (Southern CA) 805-371-5381
CA Tustin, Sales Off. (Southern CA) 714-258-8303
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CO Longmont, Luscombe Engnr 303-772-3342
CT Wallingford, Technology Sales, Inc. 203-269-8853
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GA Norcross, Sales Office (South Eastern Area) 404-263-7601
GA Tucker, REP, Inc. 404-938-4358
ID Meridian, Intermountain Tech Mtkg 208-888-6071
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OH Dayton, Thompson & Assoc 513-435-7733
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TX Piano, Sales Off. (South Central Area) 214-985-2334
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IL Elgin, RHI Sales Corp 312-888-0099
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MA Woburn, Alpha Omega 617 933-0237
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WA Bellevue, Quest Mktg 206-747-9424

CONTROL DATA, Computer Systems and Services, P.O. Box 0, Minneapolis, Minnesota 55440, Tel: 612-853-8390

CONTROL DATA, Scientific Information Services, 8100-34th Ave. South, Minneapolis, Minnesota 55420, Tel: 612-853-3511

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Intl Japan, Tokyo, Cornes & Co., Ltd. 03-272-5771
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FL Clearwater, CM Mktg, Inc. 813-443-6390
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MO St.Charles, Stan Clothier Co. 314-928-8078
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Intl Spain, Barcelona, Comelta, S.A. 93-582-1991
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Intl United Kingdom, Surrey, Crystal Semiconductor UK Ltd. 44-0276-685761
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CUSTOM ARRAYS CORP., 525 Del Rey Ave., Sunnyvale, California 94086, Tel: 408-749-1166, TELEX: 5106005119

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CT Danbury, HLM 203-791-1878
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FL Clearwater, CM Mktg 813-443-6390
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GA Norcross, Group 2000 Sales Inc. . 404-729-1889
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IA Cedar Rapids, Midwest Tech. Sales 319-393-5115
KS Goddard, Midwest Tech Sales 316-794-8565
KS Lenexa, Midwest Tech. Sales 913-888-5100
KY Louisville, Technology Mktg. Corp 502-893-1377
MD Columbia, Cypress Semiconductor 301-740-2087
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MN Minnetonka, Cypress Semiconductor 612-935-7747
MO Earth City, Midwest Tech Sales ... 314-298-8787
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NM Albuquerque, Techni-Source, Inc. . 505-268-4232
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NY Poughkeepsie, Cypress Semiconductor 914-485-6375
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NC Raleigh, Cypress Semiconductor . 919-870-0880
OH Dayton, KW Elect. Sales 513-890-2150
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OR Beaverton, Cypress Semiconductor 503-626-6622
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IN Indianapolis, Marshall Inds 317-297-0483
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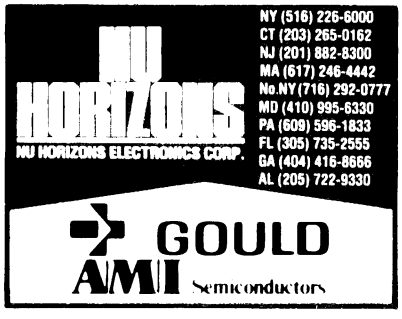

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CA San Diego, Insight Elec., Inc. 619-587-1100
CA Sunnyvale, Insight Elec., Inc. 408-720-9222
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NY Smithtown, Vantage Comps., Inc. . 516-543-2000
OR Beaverton, Insight Elec., Inc. 800-677-7716
TX Austin, Insight Elec., Inc. 512-335-3707
TX Richardson, Insight Elec., Inc. 214-783-0800
TX Sugarland, Insight Elec., Inc. 713-448-0800
WA Kirkland, Insight Elec., Inc. 206-820-8100
Intl Japan, Tokyo, Synerdyne, Inc. 03-3461-9311
Intl Japan, Tokyo, Synerdyne, Inc. 03-3764-5350

MOSEL, 914 West Maude Avenue, Sunnyvale, California 94086, Tel: 408-733-4556, FAX: 408-773-8415

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AZ Phoenix, Compass Mktg & Sales . 602-996-0635
AZ Tuscon, Compass Mktg & Sales .. 602-577-5146
CA Escondido, Eagle Tech Sales 619-743-6550
CA Irvine, Strong & Assocs. 714-261-7233
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CA Sunnyvale, Mosel(Western Sales Office) 408-733-4556
CT Hamden, Datcom 203-288-7005
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FL Boca Raton, Electramark 407-392-1763
FL Tampa, Electramark 813-889-7775
GA Norcross, Electramark 404-446-7915
IL Schaumburg, Victory Sales Inc. ... 708-490-0300
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KS Kansas City, BC Electrns 913-342-1211
MD Columbia, Avtech Assocs. 301-740-5100
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MI Detroit, R.P. Urban 313-535-7109
MI Grand Rapids, R.P. Urban 616-245-0511
MN St. Paul, Cahill, Schmitz & Cahill .. 612-646-7217
MO Bridgeton, BC Electrns 314-739-6683
NH Nashua, Mosel(Northeastern Sales Office) 603-891-2007
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NJ Haddonfield, Tritek Sales 609-429-1551
NM Albuquerque, Compass Mktg & Sales 505-344-9990
NY Syracuse, Pi'Tronics 315-455-7346
NC Mathews, ADI 101972
NC Smithfield, ADI 919-934-8136
OH Centerville, Omega Sales 513-434-5507
OH Cleveland, Omega Sales 216-360-9400
OR Beaverton, Electra Tech. Sales ... 503-643-5074
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TX Carrollton, Impaq Sales Company 214-247-3000
TX Houston, Impaq Sales Co. 713-820-0288
TX Richardson, Mosel(Central & Southeastern Sales Office) 214-690-1402
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WA Kirkland, Electra Tech. Sales 206-821-7442
WI Menomenee Falls, Victory Sales Inc. 414-255-6016
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CA Anaheim, TIME Electrns 714-937-0911
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WA Redmond, Merit Electrns 206-869-7557
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CA Gardena, Hamilton/Avnet Electrns .....
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CA Irvine, Hall-Mark Electrns 714-727-6000
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CA Irvine, Wyle Labs Corporate 714-851-9953
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AL Huntsville, Electrn Mfgs' Agents .. 204-830-4030
AZ Phoenix, Sun State Tech, Inc. 602-220-0595
CA Los Angeles, NCR Microelec Div. . 213-643-4466
CA Newport Beach, NCR-Southwest Sales 714-474-7095
CA Newport Beach, Leading Concepts 714-851-0654
CA Newport Beach, NCR Microelec Div. 714-474-7095
CA San Diego, Earle Assoc, Inc. 619-278-5441
CA San Jose, NCR-Northwest Sales . 408-441-1080
CA Santa Clara, NCR MicroelecDiv. .. 408-727-6576
CO Aurora, Electrodyne Inc. 303-695-8903
CO Colorado Springs, NCR Microelec. Prod. Div. 719-596-5611
CO Ft. Collins, NCR Microelec. Prod. Div. 303-226-9500
CT Southbury, Dynamic Technologies 203-262-6220
FL Clearwater, Delmac Sales, Inc. 813-443-2622
FL Deerfield, Delmac Sales, Inc. 305-427-7788
FL Longwood, Delmac Sales, Inc. 407-831-0040
GA Alpharetta, NCR-Southeast Sales . 404-740-9151
GA Roswell, Electrn Mfg's Agents 404-992-7240
GA Roswell, NCR Microelec Div. 404-587-3136
IL Rolling Meadows, Eagle Tech Sales, Inc. 312-991-0700
IN Carmel, Bailey's Electrns Sales & Tech., Inc. 317-848-9958
IA Cedar Rapids, Dy-Tronix, Inc. 319-377-8275
KS Leawood, Dy-Tronix, Inc. 913-339-6333
KS Wichita, Dy-Tronix, Inc. 316-838-0884
MA Tewksbury, Pro Comp Assoc, Inc . 617-858-0100
MA Woburn, NCR Microelec Div. 617-933-0778
MI Grand Rapids, Rathsburg Assoc, Inc. 616-949-7400
MI Southfield, Rathsburg Assoicates, Inc. 313-559-9700
MN Bloomington, NCR Microelec Div. . 612-941-7075
MN Eden Prairie, Aldridge Assoc. 612-944-8433
MO Bridgeton, Dy-Tronix, Inc. 314-291-4777
NM Albuquerque, Nelco Elctrns. 505-293-1399
NY Binghamton, Ontec Electrn Mktg .. 607-724-5266
NY Melville, Comtronic Assoc, Inc. 516-249-0505
NY Rochester, Ontec Electrn Mktg. ... 716-464-8636
NY Syracuse, Ontec Electrn Mktg 315-425-9800
NY Wappinger Falls, Ontec ElectrnMktg. 914-462-7188
NC Raleigh, Electrn Mfg's Agents 919-846-6888
OK Tulsa, ION Assocs., Inc. 918-481-2199
OR Portland, Westerberg & Assoc 503-620-1931
PA Westchester, TCA Assocs. 215-692-6853
TX Austin, ION Assocs., Inc. 512-331-7251
TX Dallas, NCR-South Central Sales . 214-733-3594
TX Grand Prairie, ION Assocs., Inc. ... 214-647-8225
TX Houston, ION Assocs., Inc. 713-537-7717
TX Plano, NCR Microelec Div. 214-578-9113
UT Salt Lake City, Electrodyne 801-264-8050
VA Front Royal, Eltron Sales, Ltd. 703-635-7201
WA Bellevue, Westerberg & Assoc 206-453-8881
Can Ontario, Har-Tech Electrns, Ltd. ... 613-726-9410
Can Ontario, Har-Tech Electrns, Ltd. ... 416-665-7773
Can Ottawa, Ontario, Ontario Centre for Microelec 613-596-6690
Can Quebec, Pointe Claire, Har-Tech Electrns, Ltd. ... 514-694-6110
Intl Australia, Braemac Pty. Ltd. . 011-61-2-858-5966
Intl England, Berkshire, Manhattan Skyline, Ltd. 44-628-75851
Intl France, Montginy Le Bretonneux, Futur IDS Composants 011-33-1-30640020
Intl Hong Kong, Asia/Pacific Sales Hdqtrs. 852-859-6044
Intl Hong Kong, Kowloon, PCI (HK), Ltd. 011-852-0-4892626
Intl Japan, Kanagawa, Japan Macnics Corp. 011-81-44-711-0022
Intl Korea, Seoul, Dongah Trading Corp. 011-82-2-784-8312
Intl Norway, Oppegard, Eurodata 47-2-992050
Intl Singapore, Datasource Electrns Private Ltd. 011-65-258-3888
Intl Taiwan (ROC) Taipei, Prospect Technology Corp. 011-886-2-721-9533
Intl West Germany, Muenchen, NCR Microelec Div. 49-89-579-31-199
Intl West Germany, Taunusstein-Hahn, Manhattan Skyline Halbleiter 011-49-6128-23044

Distributors

AL Huntsville, Pioneer Standard 205-837-9300
AZ Tempe, Anthem Electrns 602-829-1800
AZ Tempe, Anthem Electrns 602-966-6600
CA Chatsworth, Anthem Electrns 818-775-0416
CA Irvine, Insight 714-727-3291
CA Irvine, Anthem Electrns 714-380-4759
CA Rocklin, Anthem Electrns 916-624-9744
CA San Diego, Insight Electrns 619-587-0903
CA San Diego, Anthem Electrns 619-453-9005
CA San Jose, Anthem Electrns 408-453-1200
CA San Jose, Pioneer Technologies .. 408-954-9100
CO Colorado Springs, Anthem Electrns 719-597-4205
CO Englewood, Anthem Electrns 303-790-4500
CT Norwalk, Pioneer Standard 203-853-1515

CT Waterbury, Anthem Electrns 203-575-1575
FL Alamonte Springs, Pioneer Technologies 407-834-9090
FL Clearwater, Pioneer Technologies 813-536-0445
FL Deerfield Beach, Pioneer Technologies 305-428-8877
GA Duluth, Pioneer Technologies 404-623-1003
GA Norcross, Pioneer Standard 404-448-1711
IL Addison, Pioneer Standard 312-495-9680
IL Elk Grove Village, Anthem Electrns 312-640-6066
IL Palatine, Ohm Electrns 312-359-5500
IL Schaumburg, Anthem Electrns ... 708-884-0200
IN Indianapolis, Pioneer Standard ... 317-573-0880
KS Lenexa, Pioneer Standard 913-492-0500
MD Columbia, Anthem Electrns 301-995-6640
MD Gaithersburg, Pioneer Standard .. 301-921-0660
MA Lexington, Pioneer Standard 617-861-9200
MA Wilmington, Anthem Electrns 617-657-5170
MI Grand Rapids, Pioneer Standard .. 616-698-1800
MI Livonia, Pioneer Standard 313-525-1800
MN Eden Prairie, Pioneer Standard ... 612-944-3355
MN Eden Prairie, Anthem Electrns 612-944-5454
NJ Fairfield, Pioneer Standard 201-575-3510
NJ Pinebrook, Anthem Electrns 201-227-7960
NY Binghampton, Pioneer Technologies 607-722-9300
NY Commack, Anthem Electrns 516-864-6600
NY Fairport, Pioneer Technologies ... 716-381-7070
NY Woodbury, Pioneer Technologies . 516-921-8700
NC Charlotte, Pioneer Technologies .. 704-527-8188
NC Durham, Pioneer Technologies ... 919-544-5400
OH Cleveland, Pioneer Standard 216-587-3600
OH Dayton, Pioneer Standard 513-236-9900
OH Reynoldsburg, Pioneer Standard . 614-221-0043
OR Beaverton, Anthem Electrns 503-643-1114, 1-800-247-7720
PA Horsham, Anthem Electrns 215-443-5150
PA Horsham, Pioneer Technologies .. 215-674-4000
PA Pittsburgh, Pioneer Technologies . 412-782-2300
TX Austin, Pioneer Standard 512-835-4000
TX Dallas, Pioneer Standard 214-386-7300
TX Houston, Pioneer Standard 713-495-4700
TX Richardson, Anthem Electrns 214-238-7100
TX San Antonio, Pioneer Standard ... 512-377-3440
UT Salt Lake City, Anthem Electrns ... 801-973-8555
WA Bothell, Anthem Electrns 206-483-1700
WA Kirkland, Insight 206-820-8100
WI Brookfield, Pioneer Standard 414-784-3480
Can Alberta, Calgary, ITT/RAE Multicomponents 403-253-8575
Can Alberta, Edmonton, ITT/RAE Multicomponents 403-451-4001
Can British Columbia, Burnaby, ITT/RAE Multicomponents 604-291-8866
Can Manitoba, Winnipeg, ITT/RAE Multicomponents 204-697-2300
Can New Brunswick, Moncton, ITT/RAE Multicomponents 506-857-8011
Can Nova Scotia, Dartmouth, ITT/RAE Multicomponents 902-465-2350
Can Ontario, Concord, ITT/RAE Multicomponents 416-763-1144
Can Ontario, Nepean, ITT/RAE Multicomponents 613-596-6980
Can Quebec, St. Laurent, ITT/RAE Multicomponents 514-335-7697
Can Saskatchewan, Saskatoon, ITT/RAE Multicomponents 306-373-7138
Intl Brazil, Sao Paulo, CPM Informatica S.A.
Intl Denmark, Kobenhavn, Exatec A/S 011-45-31-19-1022
Intl Denmark, Solkeborg, Micronor 011-45-86-816522
Intl France, Cedex, Tekelec Airtronic 011-331-46-232425
Intl France, Montigny Le Bretonne, Futur Composants 33-1-30-961900
Intl Israel, Tel Aviv, Israel Intl Purch I.E. Mittwoch & Sons, Ltd. ..... Telex 03-2160
Intl Italy, Milano, Dis El SpA 011-39-39-6056171
Intl Italy, Milano, Skylab 011-39-2-667-10-822
Intl Netherlands, Zoetermeer, Akam Electrns 011-31-79-443200
Intl Norway, Oppegard, Eurodata .. 011-47-2-992050
Intl Sweden, Bromma, IE Komponenter 011-46-8-804685
Intl United Kingdom, Berkshire, Manhattan Skyline, Ltd. 44-628-75851
Intl West Germany, Martinsreid, Atlantik Electrn GmbH 011-49-89-857-0000
Intl West Germany, Taunusstein-Hahn, Manhattan Skyline Halbeite 49-6128-23044

NEC ELECTRONICS INC., 401 Ellis Street, Mountain View, California 94039, Tel: 415-960-6000, TELEX: 3715792

Sales Office & Representatives

AL Hutsville, 20th Century Mrktg. 205-772-9999
AZ Phoenix, Oasis Sales, Inc 602-277-2714
CA Cardiff, Mission Technology 619-753-5092
CA Encino, NEC Electrns (Northwest) 818-342-3112
CA Mountain View, ASIC Design Center 415-965-6142
CA Mountain View, NEC Electrns (Northwest) 415-965-6200
CA San Jose, Exis 408-456-1650
CA Santa Ana, ASIC Design Centers . 714-546-0501
CA Santa Ana, NEC Electrns (Northwest) 714-546-0501
CO Aurora, NEC Electrns (Northwest) 303-755-6353
CO Englewood, Compass Mktg. and Sales Inc. 303-721-9663
CT Cheshire, Datatrack Engnr, Inc. 203-271-1311
FL Altamonte Springs, V.G. Sales Co. Inc. 407-831-8688
FL Cooper City, NEC Electrns (Eastern) 305-436-8114
FL Ft. Lauderdale, V.G.Sales Co. Inc. . 305-938-4333
FL Largo, V.G. Sales Co. Inc. 813-536-7787
FL Maitland, NEC Electonics (Southeast) 407-875-1145
GA Norcross, 20th Century Mktg Inc. . 404-446-1999
GA Norcross, NEC Electrns (Southeast) 404-447-4409
ID Compass Mktg. and Sales 208-344-2955
IL Arlington Heights, ASIC Design Center 312-398-3600
IL Arlington Heights, NEC Electrns (Midwest) 708-577-9090
IL Schaumburg, Martan Inc. 708-303-5660
IN Carmel, Technology Mktg Corp. .. 317-844-8462
IN Ft. Wayne, Technology Mktg Corp. 219-432-5553
IN Kokomo, Technology Mktg. Corp. . 317-459-5152
IA Cedar Rapids, Stan Clothier Co. .. 319-393-1576
KS Overland Park, AME Sales 913-492-3971
KY Louisville, Technology Mktg Corp. 502-893-1377
MD Glen Burnie, TRI-MARK Inc. 301-761-6000
MA Natick, ASIC Design Center 508-655-8833
MA Natick, NEC Electrns (Northeast) . 508-650-4100
MA Woburn, Compass Technology ... 617-933-3336
MI Grand Rapids, Miltimore Sales 616-942-9721
MI Novi, Miltimore Sales 313-349-0260
MI Troy, NEC Electrns (Midwest) 313-680-0506
MN Bloomington, NEC Electrns (Midwest) 612-854-4443
MN Eden Prairie, Stan Clothier Company 612-944-3456
MO St. Charles, AME Sales 314-928-2599
NJ Fairfield, Metro Logic Corp. 201-575-5585
NJ Moorestown, TAI Corp. 609-778-5353
NY Fairport, NEC Electrns (Northeast) 716-425-4590
NY Fishkill, NEC Electrns (Northeast) 914-887-2101
NY Melville, NEC-Eastern Region 516-753-7526
NY Pittsford, Elcom Sales 716-385-1400
NY Skaneateles, Elcom Sales 315-685-8245
NC Charlotte, Quantum Mktg Inc. 704-523-8822
NC Durham, ASIC Design Center 919-544-4132
NC Durham, NEC Electrns (Southeast) 919-544-4132
NC Raleigh, Quantum Mktg Inc. 919-846-5728
OH Columbus, NEC Electrns (Midwest) 614-436-1778
OH Pepper Pike, NEC Electrns (Midwest) 216-831-0067
OR Portland, Venture Electrns 503-624-0617
OR Tigard, NEC-Western Region 503-671-0177
OR Tigard, ASIC Design Center 503-671-0177
PA Allentown, NEC Electrns (Northeast) 215-391-9094
TN Knoxville, 20th Century Mktg, Inc. . 615-966-2099
TX Austin, TL Mktg, Inc. 512-837-7272
TX Dallas, ASIC Design Center 214-250-4522
TX Dallas, TL Mktg, Inc. 214-484-6800
TX Dallas, NEC Electrns (South Central) 214-931-0641
TX Houston, NEC Electrns (Central) .. 713-955-2191
TX Houston, TL Mktg, Inc. 713-587-8100
TX Leander, NEC-Midwest 512-259-4947
UT Compass Mktg. and Sales Inc. 801-355-9663
WA Bellevue, Venture Electrns 206-454-4594
WI Mequon, Martan Inc. 414-241-4955
Can British Columbia, Burnaby, Kaytronics Western 604-294-2000
Can Ontario, Concord, Kaytronics 416-669-2262
Can Ontario, Kanata, Kaytronics 613-592-6606
Can Quebec, Ville St-Laurent, Kaytronics 514-745-5800
PR Mayaguez, V.G. Sales Co. Inc. 809-831-4150

Distributors

AL Huntsville, Marshall Inds 205-881-9235
AL Huntsville, Reptron Electrns 800-722-5055
AZ Phoenix, Marshall Inds. 602-496-0290
AZ Phoenix, Sterling Electrns 602-437-5565
AZ Tempe, Insight Electrns 602-829-1800
CA Agoura, Insight Electrns 818-707-2101
CA Agoura Hills, Western Microtechn. 818-707-0377
CA Calabasas, Marshall Inds. 818-878-7000
CA Camarillo, Milgray Electrns 805-484-4055
CA Costa Mesa, Eric Electrns 714-751-1185
CA El Monte, Marshall Inds. 818-307-6048
CA Fountain Valley, Bell Microproducts 714-963-0667
CA Irvine, Insight Electrns 714-727-3291
CA Irvine, Marshall Inds. 714-859-5050
CA Milipitas, Marshall Inds. 408-942-4600
CA Milpitas, Bell Microproducts 408-434-1150
CA Orange, Western Microtechn. 714-637-0200
CA Rancho Cordova, Marshall Inds. .. 916-635-9700
CA San Diego, Insight Electrns 619-587-9757
CA San Diego, Marshall Inds. 619-578-9600
CA San Diego, Western Microtechn. .. 619-453-8430
CA San Jose, Eric Electrns 408-432-1111
CA San Jose, Merit Elec. 408-434-0800
CA Saratoga, Western Microtechn. ... 408-725-1660
CA Sunnyvale, Insight Electrns 408-720-9222
CA Thorton, Marshall Inds. 303-451-8383
CO Englewood, Sterling Electrns 303-792-3939
CT Milford, Milgray Electrns 203-878-5538
CT Wallingford, Marshall Inds. 203-265-3822
CT Wallingford, Sterling Electrns ... 1-800-800-9535
FL Altamonte Springs, Marshall Inds. . 407-767-8585
FL Ft. Lauderdale, Marshall Inds. 305-977-4880
FL Ft. Lauderdale, Reptron Electrns .. 305-735-1112
FL St. Petersburg, Marshall Inds. 813-573-1399
FL Tampa, Reptron Electrns 813-854-2351
FL Tampa, Reptron Electrns 813-855-4656
FL Winter Park, Milgray Electrns 407-647-5747
GA Norcross, Marshall Inds. 404-923-5750
GA Norcross, Milgray Electrns 404-446-9777
GA Norcross, Reptron Electrns 404-446-1300
IL Palatine, Milgray Electrns 708-202-1900
IL Schaumburg, Marshall Inds. 708-490-0155
IL Schaumburg, Sterling Electrns 708-303-9900
IL Schaumburg, Reptron Electrns ... 708-882-1700
IN Indianapolis, Marshall Inds. 317-297-0483
KS Lenexa, Marshall Inds. 913-492-3121
KS Lenexa, Sterling Electrns 913-492-5406
KS Overland Park, Milgray Electrns ... 913-236-8800
MD Columbia, Milgray Electrns 301-995-6169
MD Columbia, Sterling Electrns 301-290-3800
MD Columbia, Vantage Comps 301-720-5100
MD Silver Spring, Marshall Inds 301-622-1118
MA Burlington, Western Microtechnology 617-273-2800
MA Hopkinton, Interface Electrns 508-435-0100
MA Wilmington, Bell Microproducts ... 508-658-0222
MA Wilmington, Marshall Ind. 508-658-0810
MA Wilmington, Milgray Electrns 508-657-5900
MA Woburn, Sterling Elec. 617-938-6200
MI Livonia, Marshall Ind. 313-525-5850

MI Livonia, Reptron Elec. 313-525-2700
MN Minneapolis, Sterling Elec. 612-831-2666
MN Minnetonka, Reptron Elec. 612-938-0000
MN Plymouth, Marshall Ind. 612-559-2211
MO Bridgeton, Marshall Ind. 314-291-4650
NJ Clifton, Vantage Comps 201-777-4100
NJ Edison, Sterling Elec. 908-417-1000
NJ Fairfield, Marshall Ind. 201-882-0320
NJ Fairfield, Western Microtechn. 201-882-4999
NJ Marlton, Milgray Electrns 609-983-5010
NJ Marlton, Western Microtech. 609-596-7775
NJ Mt. Laurel, Marshall Ind. 609-234-9100
NJ Parsippany, Milgray 201-335-1766
NM Albuquerque, Sterling Electrns 505-884-1900
NY Endicott, Marshall Inds. 800-678-0010
NY Farmingdale, Milgray Electrns 516-420-9800
NY Hauppauge, Marshall Inds. 516-273-2424
NY Pittsford, Milgray Electrns 716-381-9700
NY Rochester, Marshall Inds. 716-235-7620
NC Raleigh, Marshall Inds. 919-878-9882
NC Raleigh, Milgray Electrns 919-790-8094
NC Raleigh, Reptron Electrns 919-870-5189
OH Columbus, Electrn Mktg 614-299-4161
OH Dayton, Marshall Inds. 513-898-4480
OH Highland Heights, Electrn Mktg ... 216-442-3441
OH Independence, Milgray Electrns ... 216-447-1520
OH Solon, Marshall Inds. 216-248-1788
OH Solon, Reptron Electrns 216-349-1415
OH Worthington, Reptron Electrns 614-436-6675
OK Tulsa, Sterling Electrns 1-800-331-3514
OR Beaverton, Insight Electrns 503-644-3300
OR Beaverton, Marshall Inds. 503-644-5050
OR Beaverton, Western Microtechnology 503-629-2082
PA Malvern, Interface Electrns 215-889-2060
PA Pittsburgh, Marshall Inds. 412-788-0441
TX Austin, Marshall Inds. 512-837-1991
TX Austin, Sterling Electrns 512-836-1341
TX Carrollton, Marshall Inds. 214-233-5200
TX Carrollton, Sterling Electrns 214-243-1600
TX Dallas, Milgray Electrns 214-248-1603
TX Houston, Marshall Inds. 1-800-392-2416
TX Houston, Sterling Electrns 713-627-9800
TX Richardson, Insight Electrns 214-783-0800
TX Stafford, Milgray Electrns 800-962-1849
UT Salt Lake City, Marshall Inds. 801-485-1551
UT Salt Lake City, Milgray Electrns ... 801-272-4999
UT Salt Lake City, Sterling Electrns ... 801-972-5444
VA Richmond, Sterling Electrns 804-226-2190
WA Bothell, Marshall Inds. 206-486-5747
WA Kirkland, Insight Electrns 1-800-677-7716
WA Redmond, Western Microtechnology 206-881-6737
WI Milwaukee, Marsh Electrns 414-475-6000
WI Waukesha, Marshall Inds. 414-797-8400
Can Alberta, Calgary, ITT Multicomponents 403-273-2780
Can Alberta, Calgary, MEMCO 403-258-3399
Can Alberta, Edmonton, ITT Multicomponents 403-436-9555
Can Alberta, Edmonton, MEMCO 403-258-3399
Can British Columbia, Victoria, MEMCO 604-383-2400
Can British Columbia,Burnaby, ITT Multicomponents 604-291-8866
Can British Columbia,Surrey, MEMCO CORP 604-590-1553
Can Manitoba, Winnipeg, ITT Multicomponents 204-786-8401
Can Manitoba, Winnipeg, MEMCO 403-258-3399
Can Ontario, Brampton, Marshall Inds. . 416-458-8046
Can Ontario, Concord, ITT Multicomponents 416-736-1144
Can Ontario, Nepean, ITT Multicomponents 613-596-6980
Can Ontario, Willowdale, Milgray Electrns 416-756-4481
Can Quebec, Point Claire, Marshall Inds. 514-694-8142
Can Quebec, St. Laurent, ITT Multicomponents 514-335-7697
Can Saskatchewan, Saskatoon, MEMCO 403-258-3399

NEWBRIDGE

FAX: 613-592-1320

NEWBRIDGE MICROSYSTEMS, 603 March Road, Kanata, Ontario, Canada K2K 2M5, Tel: 613-592-0714, 1-800-267-7231 (from USA), TELEX: 053-4501, FAX: 613-592-1320

Sales Office & Representatives

AL Huntsville, Cartwright & Bean Inc. . 205-836-1540
CA Livermore, United Tecnical Mktg .. 415-449-7644
CT Guilford, Datamark Inc. 203-453-0575
CT South Windsor, George Urban & Assosc. 203-644-5471
FL Orlando, Cartwrigth & Bean Inc. ... 407-422-4531
GA Norcross, Cartwright & Bean Inc. . 404-368-0160
IL Bensenville, Horizon Tech. Sales . 708-860-7900
MD Baltimore, Conroy Sales Co. 301-296-2444
MA Dover, George Urban & Assocs. .. 617-329-4068
MN Eden Prairie, PWC Incorporated .. 612-934-1409
NH Londonerry, George Urban & Assocs. 603-437-3622
NY Commack, MLV Technologies 516-499-9152
NC Charolotte, Cartwright & Bean Inc. 704-536-0303
NC Raleigh, Cartwright & Bean Inc. ... 919-876-4130
OH Aurora, EMA Inc. 216-562-6104
OH Centerville, EMA Inc. 513-433-2800
PA West Chester, TCA & Assoc 215-692-6853
TN Knoxville, Cartwright & Bean Inc .. 615-693-7450
TX Austin, Oeler & Menelaides 512-453-0275
TX Dallas, Oeler & Menelaides 214-361-8876
WA Redmond, Salestech Assoc 206-883-9374
Can Alberta, Calgary, Deskin Sales 403-270-4440
Can Alberta, Edmonton, Deskin Sales . 403-466-2106
Can British Columbia, Vancouver, Deskin Sales 604-324-8343
Can Manitoba, Transcona, Deskin Sales 403-466-2106
Can Ontario, Markham, Deskin Sales (Head Office) ... 416-475-1412
Can Ontario, Nepean, Deskin Sales ... 613-228-1201
Can Quebec, St. Laurent, Deskin Sales 514-331-2860
Intl Australia, NSW, Petersham, Uni-Carter Semiconductor 02-550-0166
Intl Australia, Queensland, Summer Park, Energy Control Intl Pty Ltd 07-376-2955
Intl Australia, Victoria, Ringwood, Dynamic Comp Sales 03-873-4755
Intl Australia, Victoria, So. Melbourne, Uni-Carter Semiconductor 03-699-5311
Intl Belgium, Microtron 011-32-1521-2223
Intl Denmark, Herlev, Nordisk Electronik . 42-842000
Intl England, Essex, Pronto Electrn Sys Ltd. 01-554-6222
Intl France, Paris, F2S 01-30-57-1854
Intl France, Velizy, Codex, Mustronic 01-34-65-9044
Intl Hong Kong, Causeway Bay, Draco Intl Ltd 5-762892
Intl India, Bombay, Balcorp (India) Pvt. Ltd. 230319,2872652
Intl Israel, Herzlia, Unitec 052-516006
Intl Italy, Milanino, El Co Mi Srl 02-619-6452
Intl Japan, Tokyo, Nippon Imex Corp .. 03-321-8000
Intl Korea, Seoul, Woo-Jin 02-715-8314
Intl New Zealand, Wellington, Energy Control 04-85-8742
Intl Singapore, BBS Electrns 748-8400
Intl Switzerland, ABALEC 011-41-1730-0455
Intl Taiwan, Taipei, Data Fast Electrns . 02-766-3226
Intl W. Germany, Frankfurt, INELCO 6101-44414
Intl W. Germany, Stuttgart, ecn-dacon GmbH 711-780-680

Distributors

CA Laguna Hills, JACO Electrns Inc. .. 714-837-8966
CA San Jose, Distel/JACO, Inc. 408-432-9290
CA Westlake Village, Distel/JACO Inc. 805-495-9998
CT Bridgeport, Park Distributors 203-366-7200
FL Longwood, JACO Electrns 407-332-0668
FL Tampa, JACO Electrns 813-628-4665
MD Columbia, JACO Electrns Inc. 301-995-6620
MA Wilmington, JACO Electrns 617-273-1860
NY Amityville, Nu Horizons 516-226-6000
NY Hauppauge, JACO Electrns 516-273-5500
WA Redmond, JACO Electrns 206-881-9700

NEXEL CORPORATION, 1556 Halford Avenue, Suite 410, Santa Clara, California 95051, Tel: 408-241-7585, FAX: 415-243-0822

JRC

FAX: 415-969-1409

NJR CORPORATION, Div. of New Japan Radio Co. Ltd., 340-B East Middlefield Rd., Mountain View, California 94043, Tel: 415-961-3901, FAX: 415-969-1409

Sales Office & Representatives

AL Huntsville, Mec-Elec Comps, Inc. . 205-852-2656
CA Escondido, Reider Assoc 619-741-0496
CA San Diego, Reider Assoc 619-741-0496
IL Berkeley, ESA Tech Mktg 708-544-0120
MA Milford, AFM Group 508-478-3355
MI Madison Heights, Dem Elec Sales, Inc. 313-583-1500
MN Eden Prairie, Comprehensive Tech. Sales Inc. 612-941-7181
NY Webster, Impaq Electrn Sales 716-265-2540
PA Harleysville, Thomas Jackson Assoc 215-256-8877
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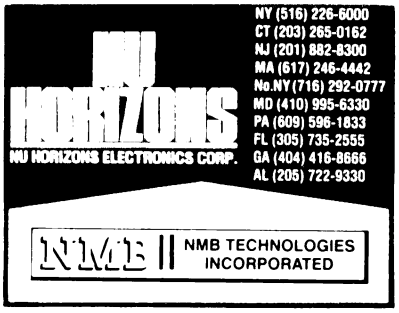

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SUPERTEX, INC., 1225 Bordeaux Drive, Sunnyvale, California 94088, Tel: 408-744-0100, TWX: 910-339-9388

Sales Office & Representatives

AL Huntsville, Macro Mktg. 205-883-9630
AZ Scottsdale, SMS & Assocs. 602-998-0831
CA Laguna Hills, H-Tech. Sls. II 714-583-1488
CA Mt. View, Straube Assocs. 415-969-6060
CA San Diego, Earle Assocs. 619-278-5441
CO Aurora, Electrodyne 303-695-8903
FL Casselbury, Dyne-A-Mark 407-831-2822
FL Ft. Lauderdale, Dyne-A-Mark 305-771-6501
GA Snellville, Macro Mktg. 404-662-5580
IL Itasca, Janus 708-250-9650
IN Ft. Wayne, Arete Sls. 219-423-1478
IN Greenwood, Arete Sls. 317-882-4407
IA Cedar Rapids, Spectrum Sales ... 319-366-0576
KS Overland Park, Spectrum Sls. 913-648-6811
MD Columbia, Robert Elec. Sls. 301-995-1900
MA Tewksbury, ProComp Assocs. 508-858-0100
MN Roseville, Vector Comps. 612-631-1334
MO Florissant, Spectrum Sls. 314-921-1313
NJ Englewood Cliffs, Supertex, Inc. (East.U.S.) 201-947-3844
NY E. Rochester, Empire Tech. Assocs. 716-381-8500
NY Skaneateles, Empire Tech. Assocs. 315-685-5703
NC Englewood Cliffs, Ed Glass Assocs. 201-592-0200
OH Centerville, Omega Sls. 513-434-5507
OH Cleveland, Omega Sls. 216-360-9400
OK Tulsa, Comptech Sls. 918-622-7744
OR Tigard, Electrn Comp. Sls. 503-245-2342
PA Hatboro, Delta Tech. Sls. 215-957-0600
TX Austin, Comptech Sls. 512-343-0300
TX Ft. Worth, Supertex, Inc.(Cent.U.S.) 817-457-5677
TX Ft. Worth, Supertex, Inc.(West.U.S.) 800-487-8737
TX Houston, Comptech Sls. 713-492-0005
TX Irving, Comptech Sls. 214-751-1181
UT Salt Lake City, Electrodyne 801-264-8050
WA Mercer Island, Electrn Comp Sls. .. 206-232-9301
WI Waukesha, Janus 414-542-7575
Can Ontario, Mississauga, R.N. Longman Sls. 416-670-8100
Can Quebec, Kirkland, R.N. Longman Sls. 514-694-3911

Distributors

AL Phoenix, Arizona Comps. 602-269-5655
CA Burbank, Elmo 818-768-7400
CA Camarillo, Milgray Electrns 805-484-4055
CA Irvine, IEC 714-837-9960
CA Sacramento, IEC 916-363-6030
CA San Diego, Neumann Elec. 619-695-3005
CA San Jose, All American Transistor 408-943-1200
CA San Jose, IEC 408-435-1000
CA San Jose, Zeus Comps. 408-629-4789
CA Torrance, All American Transistor 213-320-0240
CA Yorba Linda, Zeus Comps 714-921-9000
CO Denver, IEC 303-292-6121
CT Milford, Milgray Electrns 800-922-6911
FL Ft. Lauderdale, All American Transistor 305-572-7999
FL Ft. Lauderdale, Nu Horizons 305-735-2555
FL Miami, All American Transistor 305-621-8282
FL Miami, Zeus Comps. 407-365-3000
FL Winter Park, Milgray Electrns 407-647-5747
GA Norcross, Milgray Electrns 404-446-9777
IL Arlington Heights, Milgray Electrns 800-322-6271
IL Hoffman Estates, IEC 708-843-2040
IN Indianapolis, CSE 317-879-9119
KS Overland Park, Milgray Electrns ... 913-236-8800
MD Columbia, Milgray Electrns 800-638-6656
MD Columbia, Nu Horizons 301-995-6330
MD Columbia, Zeus Comps 301-997-1118
MD Rockville, All American Transistor 301-251-1205
MA Beverly, Sertech 508-927-5820
MA Wakefield, All American Transistor 617-248-2300
MA Wakefield, Nu Horizons 617-246-4442
MA Wakefield, Zeus Comps. 617-246-8200
MA Wilmington, Milgray Electrns 508-657-5900
MN Minneapolis, All American Transistor 612-944-2151
NJ Marlton, Milgray Electrns 609-983-5010
NJ Marlton, Nu Horizons 609-596-1833
NJ Parsippany, Milgray Electrns 201-335-1766
NJ Pine Brook, Nu Horizons 201-882-8300
NJ W. Berlin, GCI Corp. 609-768-6767
NM Albuquerque, Electrn Devices 505-822-1300
NY Amityville, Nu Horizons 516-226-6000
NY Farmingdale, Milgray Electrns 800-Milgray
NY Mt. Vernon, All American/QAR ... 914-699-2224
NY Pittsford, Milgray Electrns 716-381-9700
NY Port Chester, Zeus Comps. 914-937-7400
NY Rochester, Nu Horizons 716-248-5980
NY Ronkonkoma, All American Transistor 516-981-3935
NY Ronkonkoma, Zeus Comps. 516-737-4500
NC Raleigh, Milgray Electrns 919-790-8094
OH Cincinnati, Schuster Electrns 513-489-1400
OH Cleveland, Milgray Electrns 216-447-1520
OH Dayton, Zeus Comps 513-293-6162
OH Twinsburg, Schuster Electrns 216-425-8134
OR Beaverton, IEC 503-641-1690
PA Marlton, Nu Horizons 215-557-6450
PA Marlton, Milgray Electrns 609-983-5010
PA W. Berlin, GCI Corp. 609-786-6767
TX Dallas, Milgray Electrns 800-637-7227
TX Richardson, All American Transistor 214-231-5300
TX Richardson, Zeus Comps. 214-783-7010
TX Stafford, Milgray 713-240-5360
UT Salt Lake City, IEC 801-977-9750
UT Salt Lake City, Milgray Electrns ... 801-272-4999
WA Bellevue, IEC 206-455-2727
Can Canada, Milgray Elec. 800-268-3315
Intl Aust./N.Zealand, Victoria, Soanar Electrns 3-727-8777
Intl Austria, Vienna, Ing. E. Steiner 222-828-4740
Intl Belgium, Wemmel, LeMaire/Rodelco Elec. 2-460-0560
Intl Denmark, Kokkedal, C-88 A.S. 42-244-888
Intl Finland, Kerava, Dalma OY 0-204-5355
Intl France, Micro Puissance 1-6907-1211
Intl Hong Kong, A & N Enterprises 852-796-3788
Intl Hong Kong, Kowloon, Leadertronics 852-3890-384
Intl India, Bangalore, SM Assocs. 91-812-356733
Intl Isreal, Nes Ziona, Codai 972-8-404264
Intl Italy, Milano, Siverstar Ltd. SPA 2-661-251
Intl Japan, Tokyo, Sys Mktg 254-2751
Intl JAPAN, TOKYO, MICROTEK, INC. 371-1811
Intl Korea, Seoul, Leadertronics Korea Co. 2-548-0942
Intl Netherlands, Breda, Rodelco B.B. Electrns 76-784-911
Intl Norway, Oslo, E.B. Nortelco 2-649-050
Intl Portugal, Lisbon, Comps. Elec. LDA 351-163-2563
Intl S. Africa, Pretoria, Communica 12-322-7613
Intl Singapore, Seamax Eng. Pvt. Ltd. .. 65-445-1828
Intl Singapore, Quad Rep Mktg. Pte.Ltd. 65-294-9998
Intl Spain,Madrid, Armitron S.A. 1-542-0906
Intl Sweden, Bromma, Integrerad Elek. Komp. AB 8-804-685
Intl Switzerland, Zurich, Egli Fischer & Co. 1-209-8111
Intl Taiwan, Commax Tech. Inc. 408-435-5000
Intl U.K., Reading,Berks, Kudos Elect. Ltd. 734-35-1010
Intl W. Germany, Goeppingen, Milgray Elec. GmbH 7161-67200
Intl W. Germany, Hamburg, Infratech ... 40-817-578
Intl W. Germany, Hannover, Topas Electrn GmbH 511-131-217
Intl W. Germany, Kirchheim, Scantec GmbH 7021-5-4027
Intl W. Germany, Planegg, Scantec GmbH 89-859-8021
Intl W. Germany, Quickborn, Topas Electrn GmbH ... 4106-73097
Intl W. Germany, Ruckersdorf, Scantec GmbH 911-5-79529

SYMPHONY LABORATORIES, 2620 Augustine Drive, Suite 250, Santa Clara, California 95054, Tel: 408-986-1701

SYNERGY SEMICONDUCTOR
CORPORATION, 3450 Central Expressway, Santa Clara, CA 95051, Tel: 408-730-1313, FAX: 408-737-0831

Sales Office & Representatives

AZ Tempe, Altek Comps 602-345-4575
AZ Tucson, Altek Comps 602-529-0443
AR Hot Springs Village, Southern States Mktg, Inc. 501-922-0807
CA Mountain View, Nexus Mfgs' Rep . 415-691-1100
CA San Diego, Excel Assoc 619-587-0545
CA Santa Ana Heights, Spectrum Rep Co. 714-251-0880
CA Santa Clara, Synergy Semi (Corp. Hdqts) 408-730-1313
CA Torrance, Spectrum Rep Co. 213-370-4860
CA Westlake Village, Spectrum Rep Co. 818-706-2919
CO Wheat Ridge, Waugaman Assoc. Inc 303-423-1020
CT Wallingford, Technolgoy Sales, Inc. 203-269-8853
MD Anapolis, Electrn Engnr & Sales Inc.) 301-269-4234
MA Waltham, Technolgoy Sales, Inc. . 617-890-5700
MN Minneapolis, HMR Inc. 612-888-2122
NY Fairport, Technology Sales, Inc. ... 716-223-7500
NY Ithaca, Technology Sales, Inc. 607-257-7070
NY Jericho, J-Squared Mktg 516-935-3200
NC Charlotte, CSR Electrns 704-847-5806
NC Raleigh, CSR Electrns 919-878-9200
OR Portland, General Electrns, Inc. ... 503-297-8500
PA Huntingdon Valley, Omega Electrns Sales, Inc. 215-947-4135
TX Austin, Southern States Mktg 512-835-5822
TX Houston, Southern States Mktg ... 713-789-2426
TX Richardson, Southern States Mktg 214-238-7500
UT Salt Lake City, Harris Mktg Inc. 801-487-5155
WA Redmond, General Electrns, Inc. .. 206-867-0969
Can Ontario, Brampton, Clark-Hurman AsSOC. 416-840-6066
Can Ontario, Nepean, Clark-Hurman Assoc 613-727-5626
Can Quebec, Pointe Claire, Clark-Hurman Assoc. 514-426-0453
Intl Germany, Munich, U.S.E. GmgH 011-49-89-33-92-92
Intl Japan, Tokyo, H.Y.Assoc. Co.Ltd 011-81-03-39297111
Intl Japan, Tokyo, Musashino, AMSC Co. Ltd. 011-81-0422-54-6801
Intl Japan, Yokohama City, Japan Manics Corp. (JMC) 011-81-045-939-6160

Distributors

AL Huntsville, Nu Horizons Electrns Corp 205-722-9330
AZ Tempe, Insight Electrns, Inc. 800-677-7716
CA Agoura, Insight Electrns, Inc. 800-667-7716
CA Irvine, Insight Electrns Inc. 800-677-7716
CA San Diego, Insight Electrns, Inc. ... 619-587-1100
CA Sunnyvale, Insight Electrns Inc. ... 800-677-7716
FL Ft Lauderdale, Nu Horizons Electrns Corp. 305-735-2555
GA Norcross, Nu Horizons Electrns Corp. 404-416-8666
MD Columbia, Nu Horizons Electrns Corp 301-995-6330
MA Wakefield, Nu Horizons Electrns Corp 617-246-4442
NJ Marlton, Nu Horizons Electrns Corp. 609-596-1833
NJ Pine Brook, Nu Horizons Electrns . 201-882-8300
NY Amityville, Nu Horizons Electrns Corp. 516-226-6000
NY Rochester, Nu Horizons Electrns Corp. 716-292-0777
OR Beaverton, Insight Electrns, Inc. ... 800-677-7716
TX Austin, Insight Electrns, Inc. 800-677-7716
TX Richardson, Insight Electrns Inc. .. 800-677-7716
TX Sugar Land, Insight Electrns, Inc. . 800-677-7716
WA Kirkland, Insight Electrns, Inc 800-677-7716

SYSTRONIX, INC., 754 East Roosevelt Avenue, Salt Lake City, Utah 84152-6398, Tel: 801-487-7412, TELEX: 6503091533, FAX: 801-487-3130

TECHNITROL, INC., 1952 East Allegheny Avenue, Philadelphia, Pennsylvania 19134, Tel: 215-426-9105, FAX: 215-426-2836

TEKTRONIX, INC., P.O. Box 500, M/S 59-420, Beaverton, Oregon 97077, Tel: 503-627-2515, TELEX: 910-467-8708, FAX: 503-627-5660

Sales Office & Representatives

AZ Mesa, System Sales of Arizona, Inc. 602-464-9989
CA Newport Beach, Leading Concept Tech. Inc 714-851-0654
CA Santa Clara, Quorum Tech Sales . 408-980-0812
CA Woodland Hills, Los Angeles Field Office 818-999-1711
CO Boulder, Tektronix, Northwest/Central Region ... 303-440-7511
GA Norcross, Twentieth Century Mktg, Inc. 404-446-1999
IL Elk Grove Vlg, Oasis Sales Corp .. 708-640-1850
IA Cedar Rapids, Oasis Sales Corp .. 319-377-8738
MD Gaithersburg, Tektronix, National Sales 301-590-7580
MA Burlington, Dynamic Sales of New England, Inc 617-272-5676
MA N. Attleboro, Eastern Region 508-699-5464
MN Bloomington, Oasis Sales corp ... 612-941-1917
NM Albuquerque, System Sales of New Mexico 505-889-2901
NC Raleigh, Twentieth Century Mktg, Inc. 919-790-9383
TN Knoxville, Twentieth Century Mktg, Inc. 615-966-2099
TX Richardson, OM Assoc. 214-690-6746
WI Brookfield, Oasis Sales Corp 414-782-6660

TELEDYNE COMPONENTS

FAX: 415-967-1590

TELEDYNE COMPONENTS, 1300 Terra Bella Avenue, P.O. Box 7267, Mountain View, California 94039-7267, Tel: 415-968-9241, TWX: 910-379-6494, FAX: 415-967-1590

Sales Office & Representatives

AL Huntsville, Group 2000 205-536-2000
AZ Scottsdale, SMS & Assoc. 602-998-0831
CA Irvine, H-Tech Sales II, Inc. 714-752-7810
CA Mountain View, Teledyne Comps . 415-968-9241
CA San Diego, Bestronics, Inc. 619-693-1111
CO Wheat Ridge, Wescom Mktg 303-422-8957
FL Clearwater, Comp Design Mktg ... 407-240-3903
FL N. Ft. Lauderdale, Comps Design Mktg 305-796-5444
FL Tampa, Comp Design Mktg 813-886-9721
GA Norcross, Group 2000 404-729-1889
ID Boise, Wescom Mktg 208-336-6654
IL Northbrook, Dolin Sales Co. 708-498-6770
IN Indianapolis, Luebbe Sales Company 317-845-5880
MD Baltimore, Teledyne Semiconductor 301-659-9880
MD Towson, Arbotek Assoc. 301-825-0775
MA Cambridge, Teledyne Comps 617-491-1670
MA North Reading, Alpha-Omega Sales 508-664-1118
MA Norwood, TELEDYNE COMPONENTS 617-255-0300
MA Norwood, Teledyne Semiconductor 617-769-9420
MI Farmington Hills, Luebbe Sales Company 313-489-8828
MN Eden Prairie, Comtek 612-941-7181
MO Florissant, Hiltec Central Inc. 816-796-6684
MO Independence, Hitec Central Inc. .. 816-796-6684
NJ Fairfield, Metro Logic 201-575-5585
NJ Mount Laurel, S-J Assoc. 609-866-1234
NY Binghamton, Gen-Tech 607-648-8833
NY Liverpool, Gen-Tech 315-451-3480
NY Penfield, Gen-Tech 716-381-5159
NY Rochester, Gen-Tech 716-467-5016
OH Cincinnati, Luebbe Sales Company 513-530-0600
OH Columbus, Luebbe Sales Company 614-431-0474
OH Dayton, Luebbe Sales Company .. 513-294-0426
OH Westlake, Luebbe Sales 216-899-0071
PA Pittsburgh, Luebbe Sales Company 412-364-0490
TX Austin, Bonser-Philhower Sales .. 512-346-9186
TX Houston, Bonser-Philhower Sales 713-782-4144
TX Richardson, Bonser-Philhower Sales 214-234-8438
TX Richardson, Bonser-Philhower ... 214-234-8438
UT Salt Lake City, Wescom Mktg 801-269-0419
WI Glendale, Dolin Sales 414-482-1111
Can British Columbia, Vancouver, Weiss Co. 604-873-1112
Can Manitoba, Winnepeg, Weiss Co. .. 204-772-3665
Can Ontario, Mississauga, Weiss Co .. 416-673-0011
Can Ontario, Nepean, Weiss Co 613-692-0617
Can Quebec, Dorval, Weiss Co. 514-685-6644
Intl England, Middlesex, Teledyne Comps 44-1-571-9596
Intl Hong Kong, Kowloon, San Po Kong, Teledyne Comps 852-3-240122
Intl Singapore, Teledyne Comps ... 011-65-273-9608
Intl West Germany, Wiesbaden, Teledyne Comps 49-611-768-0

Distributors

AL Huntsville, Future Electrns 205-830-2322
AL Huntsville, Marshall Inds 205-881-9235
AL Huntsville, Nu Horizons 205-722-9330
AZ Phoenix, Future Electrns 602-968-7140
AZ Phoenix, Marshall Inds 602-496-0290
CA Agoura Hills, Zeus Comps 818-889-3838
CA Burbank, Elmo Semiconductor Corp 818-767-7038
CA Calabasas, Marshall Ind. 818-878-7000
CA Chatsworth, Future Electrns 818-772-6240
CA Chatsworth, Marshall Inds 818-407-0101
CA El Monte, Marshall Inds 818-307-6000
CA Fountain Valley, All American 714-435-0115
CA Irvine, Marshall Inds 714-458-5301
CA Irvine, Future Electrns 714-250-4141
CA Milpitas, Marshall Inds 408-942-4600
CA Rancho Cordova, Marshall Inds .. 916-635-9700
CA San Diego, All American 619-458-5850
CA San Diego, Marshall Ind. 619-578-9600
CA San Diego, Zeus Comps 619-277-9681
CA San Diego, Future Electrns 619-278-5020
CA San Diego, Marshall Inds 619-578-9606
CA San Jose, Zeus compoents 408-629-4789
CA San Jose, Future Electrns 408-434-1122
CA San Jose, All American 408-943-1200
CA Torrance, All American 213-320-0240
CA Yorba Linda, Zeus Comps 714-921-9000
CO Broomfield, Future Electrns 303-421-0123
CO Denver, IEC 303-292-6121
CO Thornton, Marshall Inds 303-451-8383
CT Bethel, Future Electrns 203-743-9594
CT Wallingford, Marshall Inds 203-265-3822
FL Altamonte Springs, Zeus Comps .. 407-788-9100
FL Altamonte Springs, Marshall Inds . 407-767-8585
FL Altamonte Springs, Future Electrns 407-767-8414
FL Ft Lauderdale, Nu Horizons 305-735-2555
FL Ft. Lauderdale, Marshall Inds 305-977-4880
FL Largo, Future Electrns 813-530-1222
FL Miami, All American 305-621-8282
FL Orlando, Chip Supply 407-298-7100
FL St. Petersburg, Marshall Inds 813-573-1399
FL Sunrise, All American 305-572-7999
GA Norcross, Nu Horizons 404-416-8666
GA Norcross, Future Electrns 404-441-7676
IL Rosemont, Advent Electrns 708-298-4210
IL Schaumburg, Future Electrns 708-882-1255
IL Schaumburg, Marshall Inds 708-490-0155
IN Indianapolis, CAM/RPC 317-578-1111
IN Indianapolis, Marshall Inds 317-297-0483
IN Indianapolis, Advent Electrns 317-872-4910
IA Cedar Rapids, Advent Electrns ... 319-363-0221
IA Cedar Rapids, Dee Electrns 319-365-7551
KS Lenaxa, Marshall Inds 913-492-3121
MD Columbia, Zeus Comps 301-997-1118
MD Columbia, Future Electrns 301-290-0600
MD Columbia, Nu Horizons 301-995-6330
MD Rockville, All American 301-251-1205
MD Silver Springs, Marshall Inds 301-622-1118
MA Bolton, Future Electrns 508-799-3000
MA Wakefield, Nu Horizons 617-246-4442
MA Wakefield, Zeus Comps 617-246-8200
MA Wakefield, All American 617-246-2300
MA Wilmington, Marshall Inds 508-658-0810
MA Wilmington, North Star Electrns ... 508-657-5155
MI Farmington Hills, Advent Electrns . 313-477-1650
MI Livonia, Future Electrns 313-261-5270
MI Livonia, Chelsea Electrn Distrib. Group 313-525-1155
MI Livonia, Marshall Inds 313-525-5850
MN Eden Prairie, All American 612-944-2151
MN Eden Prairie, Future Electrns 612-944-2200
MN Plymouth, Marshall Inds 612-559-2211
MO Bridgeton, Marshall Inds 314-291-4650
MO St Louis, Future Electrns 314-469-6805
NJ Fairfield, Marshall Inds 201-882-0320
NJ Marlton, Nu Horizons 609-596-1833
NJ Marlton, Future Electrns 609-596-4080
NJ Mt. Laurel, Marshall Inds 609-234-9100
NJ Parsippany, Future Electrns 201-299-0400
NJ Pinebrook, Nu Horizons 201-882-8300
NY Endicott, Marshall Ind. 607-785-2345
NY Hauppauge, Marshall Inds 516-273-1515
NY Hauppauge, Future Electrns 516-273-2424
NY Johnson City, Marshall Ind. 607-798-1611
NY Liverpool, Future Electrns 315-451-2371
NY N. Amityville, Nu Horizons 516-226-6000
NY Port Chester, Zeus Comps 914-937-7400
NY Rochester, CAM/RPC Elec. 716-427-9999
NY Rochester, Nu Horizons 716-248-5980
NY Rochester, Future Electrns 716-272-1120
NY Rochester, Marshall Inds 716-235-7620
NY Ronkonkoma, Zeus Comps 516-737-4500
NY Ronkonkoma, All American 516-981-3935
NC Concord, Future Electrns 704-455-9030
NC Raleigh, Marshall Inds 919-878-9882
NC Raleigh, Future Electrns 919-790-7111
OH Cleveland, CAM/RPC 216-461-4700
OH Columbus, CAM/RPC 614-888-7777
OH Dayton, Marshall Inds 513-898-4480
OH Dayton, CAM/RPC 513-433-5551
OH Maryland Heights, Future Electrns 216-449-6996
OH Solon, Marshall Inds 216-248-1178
OR Beaverton, Marshall Inds 503-644-5050
OR Beaverton, Future Electrns 503-645-9454
PA Pittsburg, CAM/RPC Electrns 215-643-2850
PA Pittsburgh, Marshall Inds 412-788-0441
TX Austin, Omni Pro Electrns 512-794-9200
TX Austin, Marshall Inds 512-837-1991
TX Brownsville, Marshall Inds 512-542-4589

TX Carrollton, Marshall Inds 214-233-5200
TX Dallas, Omni Pro Electrns 214-233-0500
TX Houston, Omni Pro Electrns 713-270-1700
TX Houston, Marshall Inds 713-985-9200
TX Houston, Future Electrns 713-556-8696
TX Richardson, Zeus Comps 214-783-7010
TX Richardson, All American 214-231-5300
TX Richardson, Future Electrns 214-437-2437
UT Salt Lake City, IEC 801-977-9750
UT Salt Lake City, Future Electrns 801-972-8489
UT Salt Lake City, Marshall Inds 801-973-2288
WA Bothel, Marshall Ind. 206-486-5747
WA Redmond, Future Electrns 206-881-8199
WI Waukesha, Future Electrns 414-786-1884
WI Waukesha, Marshall Ind. 414-797-8400
Can Alberta, Edmonton, Future Electrns 403-250-5550
Can Alberta,Calgary, Future Electrns .. 403-250-5550
Can British Columbia, Vancouver, Future Electrns 604-294-1166
Can Manitoba, Winnipeg, Future Electrns 204-786-7711
Can Ontario, Brampton, Marshall Inds . 416-458-8046
Can Ontario, Mississuaga, Future Electrns 416-612-9200
Can Ontario, Ottawa, Future Electrns .. 613-820-8313
Can Quebec, Pointe Claire, Marshall Ind. 514-694-8142
Can Quebec, Pointe Claire, Future Electrns 514-694-7710
Can Quebec, Quebec City, Future Electrns 418-877-6666
Intl Argentina, Buenos Aires, Tinko SA 49-6060
Intl Australia, Melbourne, Promark Electrns Pty. Ltd. 03-878-1255
Intl Australia, Sydney, Promark Electrns Pty. Ltd. 02-439-6571
Intl Brazil, Brooklin, Hitech Comerciale Industrial Ltd. 011-533-9566
Intl Denmark, Copenhagen, E.V. Prescom A.S. 01-83-90-22
Intl Finland, Helsinki, OY Fintronic AB 90-692-60-22
Intl France, Sevres, Tekelec Airtronic SA 01-45-34-75-35
Intl Germany, Kussaberg, Semitron W. Rock GmbH 07742-7011
Intl Germany, Quickborn, Adelco Elektronik GmbH 04106-2024
Intl Germany, Taufkirchen, Neumuller GmbH 089-61208-0
Intl Germany, Unterhaching, Metronik Gmbh 089-611080
Intl Hong Kong, Kwai Chung, Renful Technology Ltd. 0-268182
Intl Hong Kong, Kwun Tong, Lowloon, 4th Floor, Liven House 3-240122
Intl Israel, Petach Tiqva, E.I.M. Intl. Electrns Ltd. 03-9233257/8/9
Intl Italy, Vicenza, Velco SRL 0444-92-29-22
Intl Japan, Osaka, Sil-Walker Inc. 06-303-4102
Intl Japan, Osaka, Tomen Electrns Corp. 06-208-3636
Intl Japan, Tokyo, Tomen Electrns Corp. 03-506-3694
Intl Japany, Tokyo, Shinjuku-Ku, Sit-Walker, Inc. 03-341-3651
Intl Korea, Seoul, Vine-Overseas Trading Corp. 266-1663/265-9875/265-3892
Intl Mexico, CD Juarez, Dicopel 4-55-40
Intl Mexico, Guadaliajara, Dicopel 26-12-32
Intl Mexico, Merida, Dicopel 3-71-04
Intl Mexico, Mexico City, Dicopel 561-32-11
Intl Mexico, Monterey, Dicopel 42-95-30
Intl Netherlands, L.I. Capelle a/d IJssel, Alcom Electrns bv 010--45-19-533
Intl New Zealand, Auckland, Actronic Sys Ltd. 09-549578/548819
Intl Orlando,FL (Mexican Distrib.), Chip Supply 305-298-7100
Intl Singapore, Scan Electrns S'pore Pte Ltd. 65-294-2112
Intl South Africa, Randburg, Fairmont Electrns Pty. Ltd. 011-789-1230/4
Intl Spain, Madrid, Amitron S.A. 01-2479313
Intl Sweden, Taby, Bexab Technology . 46-87328980
Intl Switzerland, Dietlikon, Omni Ray AG 01-8352111
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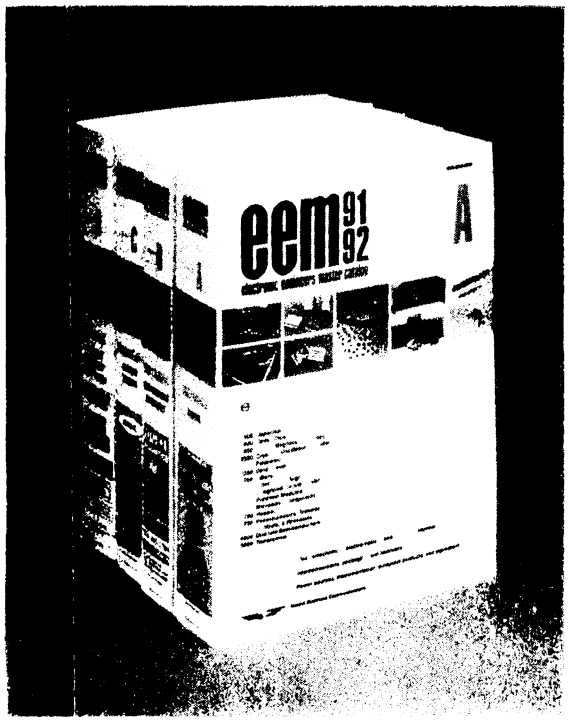

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Actel

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Product Family Profile

Device	CMOS Process	Applications	Speed Grades	Packages
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A1010A, A1020A	1.2 µm	C, I, M, B	Standard, -1, -2	PLCC, JQCC, CQFP, CPGA

Important:
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- Wide-Input Combinatorial Functions
- Up to 1232 Programmable Logic Modules
- Up to 998 Flip-Flops Available
- 16-Bit Counter Performance to 85 MHz
- 16-Bit Accumulator Performance to 33 MHz
- Flip-Flop Toggle Rates to 120 MHz
- Two In-Circuit Diagnostic Probe Pins Support Speed Analysis to 50 MHz
- Two High-Speed, Low-Skew Clock Networks
- I/O Drive to 10 mA
- Nonvolatile, User Programmable

Product Family Profile

Device	A1280	A1240	A1225
Capacity			
Gate Array Equivalent Gates	8,000	4,000	2,500
PLD/LCA Equivalent Gates	20,000	10,000	6,250
TTL Equivalent Packages	210	105	70
20-Pin PAL Equivalent Packages	69	34	23
Logic Modules	1,232	684	451
S-Modules	624	348	231
C-Modules	608	336	220
Flip-Flops (maximum)	998	565	382
Routing Resources			
Horizontal Tracks/Channel	36	36	36
Vertical Tracks/Column	15	15	15
PLICE® Antifuse Elements	750,000	400,000	250,000
User I/Os (maximum)	140	104	83
Packages[1]	176 CPGA 160 PQFP	132 CPGA 144 PQFP	100 CPGA 100 PQFP 84 PLCC
Performance[2]			
16-Bit Counters	55 MHz	75 MHz	85 MHz
16-Bit Accumulators	30 MHz	33 MHz	33 MHz
CMOS Process	1.2 µm	1.2 µm	1.2 µm

Note:
1. See product plan on page 4 for package availability.
2. Performance is based on -1 speed graded device at commercial worst-case operating conditions.

Description

The ACT 2 family represents Actel's second generation of field programmable gate arrays. The ACT 2 family introduces a two-module architecture, consisting of C-Modules and S-Modules, which is optimized for both combinatorial and sequential designs (see Figure 1). Based on Actel's patented channeled array architecture, the ACT 2 family provides significant enhancements to gate density and performance while maintaining upward compatibility with the ACT 1 design environment. The devices are implemented in silicon gate, 1.2-µm, two-level metal CMOS, and employ Actel's PLICE antifuse technology. This revolutionary architecture offers gate array design flexibility, high performance and fast time-to-production through user programming. The ACT 2 family is supported by the Action Logic™ System (ALS) which offers automatic pin assignment, validation of electrical and design rules, automatic placement and routing, timing analysis, user programming, and debug and diagnostic probe capabilities. The Action Logic System is available on Sun™, HP®, Apollo® and 386/486 PC platforms, with CAE interfaces to Valid™, Viewlogic®, Mentor Graphics® and OrCAD™ design environments.

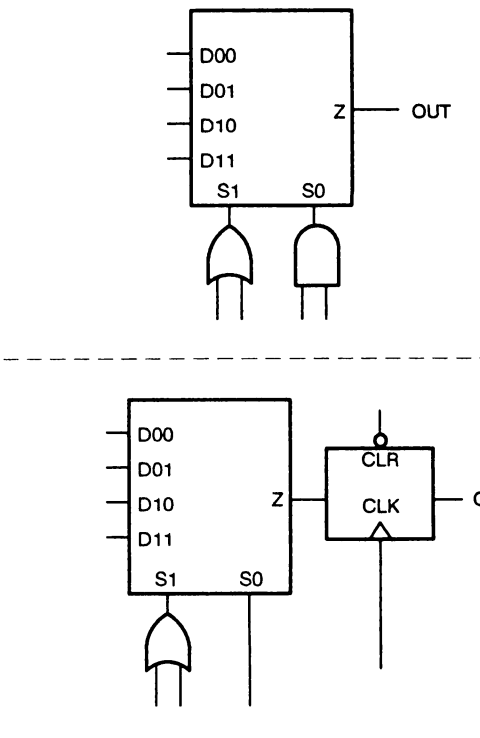

Figure 1. C-Module and S-Module Configurations

Actel

FPGAs are Better for State Machines than PLDs

By Warren Miller, Product Planning Manager

It is a common misconception that FPGAs, with their register-rich and fast narrow-gating architectures, are inefficient for state machines compared to PLD architectures. In fact, FPGAs allow faster and cheaper state machine implementations than PLDs and are easier to design.

The traditional methodology for designing state machines has been to draw a state diagram, map the states into the minimum number of register bits needed to encode the state and determine the next state function from a Karnaugh map or equivalent technique. This results in a minimum number of registers but usually requires wide gating to determine the next state bit. PLDs are register lean but can do wide gating, so their architecture fits into this methodology fairly easily. It is no wonder that designers see PLDs as being best for state machines.

FPGAs, however, offer designers a different set of resources. Registers are abundant and gating is optimized for more narrow functions. A state machine designed to take advantage of the abundance of registers available on an FPGA is more efficient than a wide logic-oriented implementation.

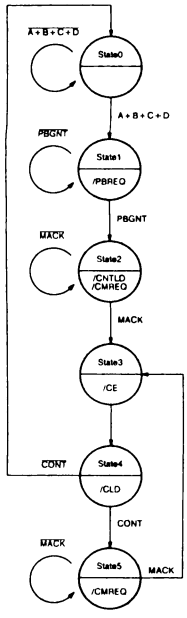

Figure 1. Example state diagram from 4-channel DMA controller

Consider the state machine illustrated in Figure 1. It is the control section of a four-channel DMA controller supermacro for Actel FPGAs and contains six states (State0, . . , State5), seven inputs (A, B, C, D, PBGNT, MACK, CONT), and five outputs (PBREQ, CNTLD, CMREQ, CE, CLD). The state transition equations for the state machine have been computed and are listed in Table 1 using PLD style logic equations:

```
State0 := /A*/B*/C*/D*State0 +/CONT*State4;
State1 := (A+B+C+D)*State0 +/PBGNT*State1;
State2 := PBGNT*State1 + /MACK*State2;
State3 := MACK*State2 + MACK*State3;
State4 := State3;
State5 := CONT*State4 + /MACK*State5;
```

Table 1. State Transition Equations for Example State Machine

The traditional approach would now map these six states into three state bits by making state assignments. If the assignments are made as indicated in Table 2, the logic in Figure 2 results.

```
State0 = /Q2*/Q1*/Q0
State1 = /Q2*/Q1* Q0
State2 = /Q2* Q1* Q0
State3 = Q2* Q1*  Q0
State4 = Q2*/Q1*  Q0
State5 = Q2*/Q1* /Q0
```

Table 2. State Assignment Used in Figure 1 Logic Design

The logic required to implement the state machine as illustrated in Figure 2 consumes 25 ACT 1 modules. (Note: A register costs two modules and the AND4A macros cost two modules each.) The longest path requires six levels of delay.

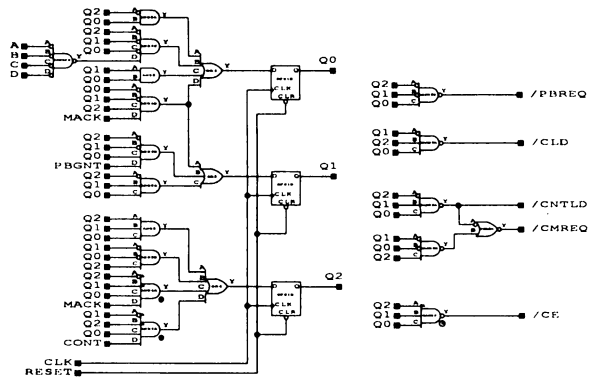

Figure 2. Encoded state machine

In many cases state assignment may be time consuming since it requires new transition terms to be determined after assigning state variables. Output logic also needs to be determined. Several iterations of state assignments may be required to get an optimal design.

When registers are not expensive, state assignment is trivial if a register is used for each state bit. In that case, the design will directly implement the transition terms given in Table 1. The logic given in Figure 3 is the result of this Bit-Per-State (BPS) logic design. It uses 19 ACT 1 modules and only requires four levels of delay. This is a 25 percent logic savings and a 40 percent speed improvement over the original register-lean design in Figure 2.

Notice that De-Morgans Theorem has been used on the logic to optimize the design. The state bits are inverted to make the states active low, and the single module OA2A and OA2 macros are used to

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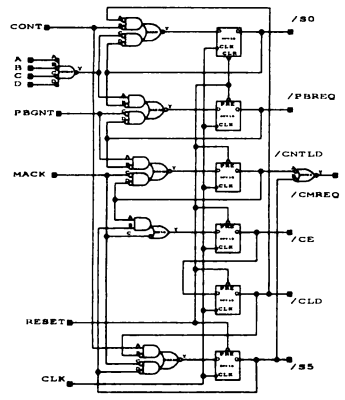

Figure 3. Bit-per-state implementation

create the transition terms. (In the ACT 1 library these macros will allow two transition terms of two inputs each to be mapped into a single module, but only one input can be active high. Making states active low allows the transition terms with active high inputs to map into the OA2A macro, and those with no active high inputs to map into the OA2 macro. Thus, ACT 1 designs will usually be most efficient using active low state bits for small state machines using the BPS design technique.) The reset signal sets all states except State0 which is cleared since it is the initial state for the machine.

If active high state bits are best suited for a particular state machine, they can also be used by clearing them on initialization and detecting the active high state for transition purposes. This can also be done when output signals need to be active high and are a direct output from the state bit. For example, if the control signal CE needed to be active high, the logic in Figure 4 would be used. Notice the three changes. The transition term feeding the state register corresponding to CE is inverted, the transition term using CE is inverted, and the CE state register is cleared on reset to establish CE as inactive. These same three changes would be required whenever an active high state or output is required. The inverse operation is required to change an active high state bit to active low.

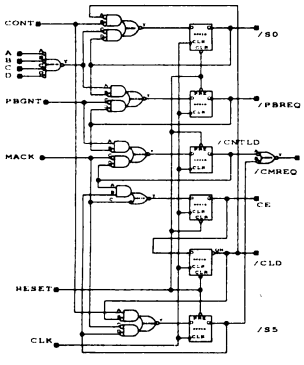

Figure 4. Active-high CE output

Larger state machines may also be implemented using this technique by distributing control to several smaller machines and using a single master machine to coordinate activities. This usually results in a higher performance design since control signals will be located near the logic they affect, minimizing routing delays. Usually it is also easier to design and debug since each machine can be more easily understood and interactions between operations are minimized.

In many cases the BPS methodology will result in a faster speed than a PLD design since the wide gating PLD delay is slower than the corresponding delay in an Actel FPGA. See Table 3 for a comparison of the delays for the designs in an Actel A1020-2 and Altera EPM5128-1™.

Also note that the cost of the FPGA implementation will be much less than a PLD implementation since a smaller fraction of the device will be needed to implement the design.

BPS design is a technique for using the register-rich architecture of FPGAs to more easily design faster and cheaper state machines. It uses the familiar state machine design methodology but bypasses the state assignment step of the design. A "cook-book" summary follows:

1) Write state transition equations for each state.

2) Assign each state to a separate register. Where possible state bits should be made active low to make it easier to construct transition terms in a single ACT 1 module.

3) Take output signals directly from state outputs where possible. If the output signal must be active high (it can almost always be made active low by making sure the control signal is active low at the destination), the state bit associated with it can be made active high by inverting that bit's transition logic and inverting that state's input to any other transition term.

4) Reset all active high state bits on machine initialization and preset active low states on initialization. The initial state must be activated on initialization so it should be cleared if active low or preset if active high.

FPGA's register-rich and fast narrow gating structure and BPS design methodology allow easier, faster and less expensive state machine implementations than PLDs.

A1020-2 Performance (Requires 19 modules out or 3.5%)		EPM5128-1 Performance (Requires 8 macros out of 128 of 547 or 6.25%)	
ABCD to Y	6.55 ns (crit)	ABCD to Reg	12 ns
Y to Reg	6.10 ns (crit)	Reg SU	6 ns
Reg SU	4.4 ns	Clk to Q	1 ns
Clk to Q	6.10 ns (crit)	Q to Feedbk	1 ns
Q to CMREQ	6.10 ns (crit)	CMREQ	12 ns
Total	29.25 ns	Total	32 ns

Table 3. Performance Comparison Between A1020-2 and EPM5128-1

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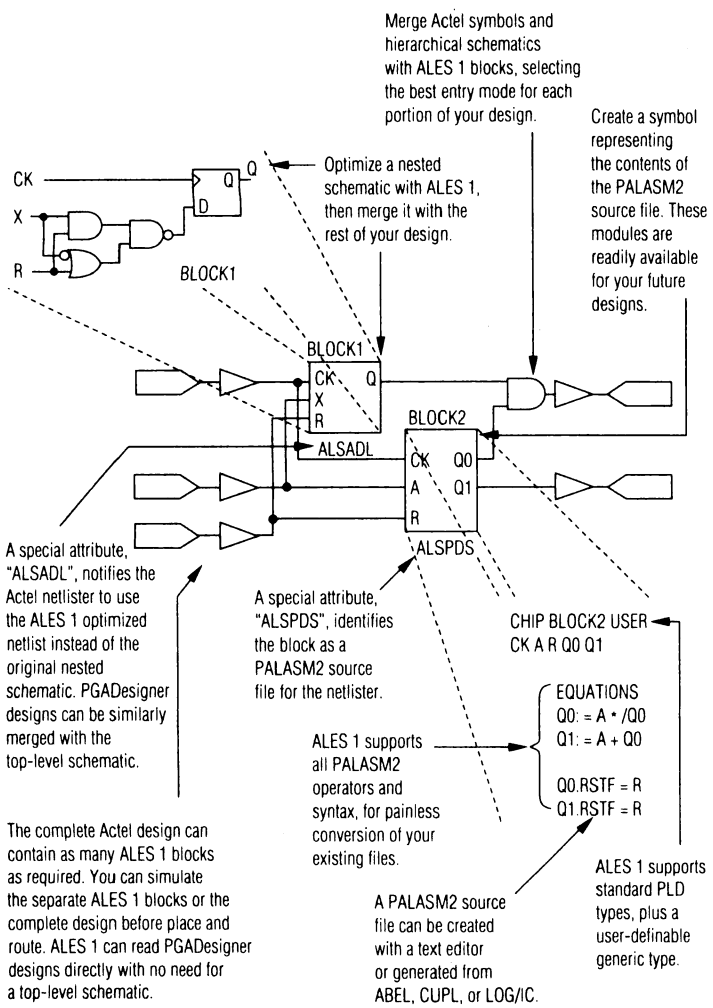
ALES™ 1
Actel Logic Enhancer/Synthesizer

USING THE ACTEL LOGIC ENHANCER AND SYNTHESIZER (ALES 1)


Merge Actel symbols and hierarchical schematics with ALES 1 blocks, selecting the best entry mode for each portion of your design.
Create a symbol representing the contents of the PALASM2 source file. These modules are readily available for your future designs.
Optimize a nested schematic with ALES 1, then merge it with the rest of your design.
CK
X
R
Q
D
BLOCK1
BLOCK2
ALSADL
ALSPDS
A special attribute, "ALSADL", notifies the Actel netlister to use the ALES 1 optimized netlist instead of the original nested schematic. PGADesigner designs can be similarly merged with the top-level schematic.
A special attribute, "ALSPDS", identifies the block as a PALASM2 source file for the netlister.
CHIP BLOCK2 USER
CK A R Q0 Q1
EQUATIONS
Q0: = A * /Q0
Q1: = A + Q0
Q0.RSTF = R
Q1.RSTF = R
ALES 1 supports all PALASM2 operators and syntax, for painless conversion of your existing files.
The complete Actel design can contain as many ALES 1 blocks as required. You can simulate the separate ALES 1 blocks or the complete design before place and route. ALES 1 can read PGADesigner designs directly with no need for a top-level schematic.
A PALASM2 source file can be created with a text editor or generated from ABEL, CUPL, or LOG/IC.
ALES 1 supports standard PLD types, plus a user-definable generic type.

Highlights

- Permits design of Actel FPGAs with familiar PLD tools ABEL™, CUPL™, LOG/IC™ and PGADesigner™
- Interfaces to Actel's Action Logic™ System (ALS) to allow painless conversion of existing PLD designs to Actel FPGAs
- Reduces design time for state machines and other sequential logic
- Optimizes logic designs from Boolean equations, state machines, or schematics for implementation in Actel FPGAs
- Multiple entry modes allow easy integration of PLD description and schematics

Fast, easy design enhancement

The Actel Logic Enhancer/Synthesizer (ALES 1) lets you quickly and easily implement logic in Actel FPGAs, using either popular PLD design tools or the familiar PALASM™2 syntax. It can provide Actel-specific logic implementation for existing files created with PLD design tools or netlist files generated from schematics. It will minimize delays or maximize logic utilization in Actel's FPGA architecture, and after creation, you can simulate either an ALES 1 block or your complete design.

What you need, when you need it

Use ALES 1 to create Actel FPGAs from a PALASM2 source file via a text editor — or generate them from ABEL, CUPL, or LOG/IC. Minc's PGADesigner produces Actel FPGA netlists directly. Used in conjunction with ALES 1, it permits system-level designs with Actel FPGAs. Or use PGADesigner to generate input for ALES 1 with schematic entry packages such as OrCAD™, P-CAD™ and FutureNet®.

ALES 1 transforms the equations and/or netlists into an Actel FPGA design file. The ALES 1 Enhancer is invoked automatically during the translation process to optimize the design for the Actel FPGA architecture.

ALES 1 uses four distinct algorithms to find the best mapping with Actel FPGA macros, based on either delay or module count, whichever suits your needs. You can specify a target value for the longest delay path; ALES 1 searches for an implementation that meets the value you require. If you specify a value of 0 ns, ALES 1 selects the fastest result found.

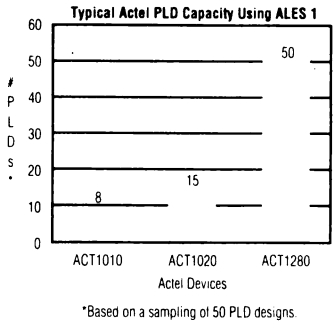
The most flexible way to design

ALES 1 is a tool that adapts to the way you already work. It puts no restrictions on the number of ALES 1 blocks your completed design contains. Each block is totally independent, allowing you complete freedom of entry mode.

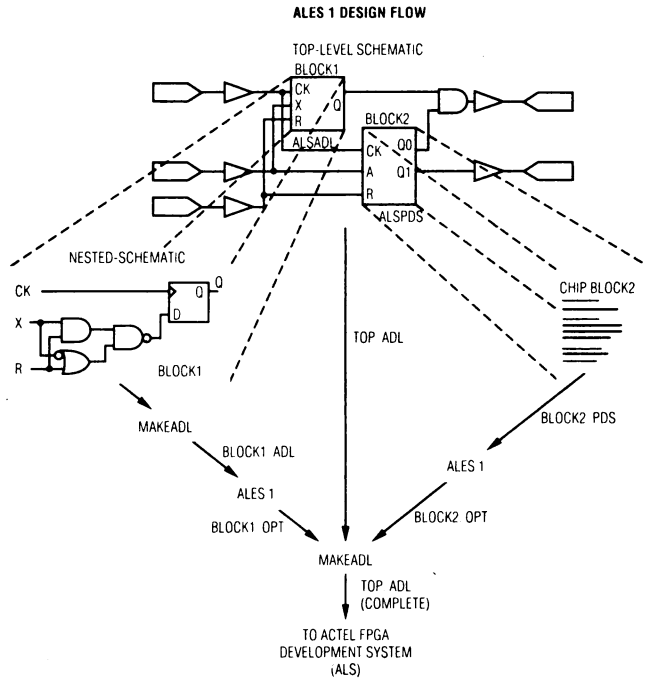
For example, you can synthesize a PLD file using ALES 1, then merge it with the rest of your top-level schematic, which contains Actel macros and hierarchical schematics. Select the best entry mode for each portion of your design.

With ALES 1, there is never any need to reinvent the wheel. You create a symbol to represent the contents of each PALASM2 source file. These modules are always ready to drop into future designs.

ALES 1 arms you with the powerful tools of Boolean equations, state description, and schematic enhancement, to let you create Actel FPGA designs ***fast***.



This graph shows the typical number of PLDs which ALES 1 can map into Actel FPGA devices.



ALES 1 supported systems

- PC386 with DOS 3.1 or higher, with either Viewlogic* 3.0 or higher or OrCAD/SDT* 3.22 or higher
- Apollo*/SR 10.1 or higher with Mentor Graphics* 7.0 or higher
- Sun-3™ with operating system 4.0.3 with a ValidGED* 9.1 or higher
- Sun-4™ with operating system 4.0.3, with either a ValidGED 9.1 or higher, and Viewlogic 4.0 or higher

ALES 1 system configuration

- 4 Mb memory (8 Mb recommended)
- 4 Mb free hard disk space
- ALES 1 software, including an ALES 1 authorization code

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Sunnyvale, CA 94086
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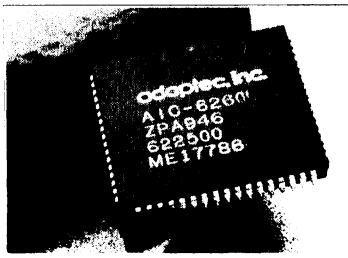
Actel

adaptec

Single-Chip AT-to-SCSI Host Adapter
AIC-6260AL: 68-pin PLCC
AIC-6260AQ: 80-pin Plastic Flat Pak

The AIC-6260 opens the world of SCSI to AT Motherboards by providing high performance and unmatched connectivity. A complete single-chip SCSI solution, the AIC-6260 features comprehensive software and design-in support, high-performance operation and complete compatibility with the SCSI-2 standard. Incorporating the AIC-6260 onto the PC Motherboard is especially easy with designed-in bus drivers allowing direct connection to AT and SCSI buses.



Architectural Overview

The AIC-6260 consists of two major functional sections: Host Interface Control and SCSI Control Logic. The AIC-6260 presents to the host processor a register-based command and control interface consisting of 32 8-bit Read/Write registers. The chip performs I/O address decoding on a 10-bit address input to the chip to map itself into one of two user-selectable starting I/O address locations: 340h or 140h. In addition, the address decode logic also generates an off-chip address select signal useful when setting up hardware jumper blocks for configuration option selection. To help simplify programming, the chip features a 16-byte RAM stack useful when saving SCSI Channel information in multithreaded applications. All signals on the Host Interface connect directly to a standard AT Bus with no buffering needed.

By using Programmed I/O, host data transfer rates approaching 4-MBytes/sec are possible by using the Repeat Instring instruction found on 80286/80386/80486, and higher, processors to take advantage of the large onboard 128-byte FIFO.

The AIC-6260 automates the most time consuming aspects of the SCSI interface with a built-in control sequencer. Through the control sequencer, SCSI Arbitration, Selection/Reselection and Data Transfers can be accomplished automatically with no intervention by the host processor. Alternatively, the host processor may individually control each SCSI signal for maximum flexibility. To assist the host in controlling SCSI operations, the AIC-6260 has available 16 interrupt conditions reflecting timing critical points in SCSI Bus operation. All AIC-6260 SCSI Bus signals feature built-in 48 mA open collector buffers allowing direct connection to SCSI Bus signals. SCSI Bus data transfers may be Asynchronous or Synchronous with up to an 8-byte offset.

Clocking for the AIC-6260 can be implemented by either using the onboard crystal oscillator circuit or an external clocking source of up to 20 MHz.

SCSI Connectivity

- Supports up to 56 logical SCSI devices
- Supports asynchronous and synchronous SCSI devices
- Programmable for either Initiator or Target operation
- Software support for up to 8 multitasking I/O processes
- Software drivers available for: Hard Disk, Streaming Tape, CD ROM, Digital Audio Tape (DAT), Magneto Optical Disk

Compatibility

- Completely SCSI-2 compatible
- Completely IBM PC AT Bus compatible
- Extensive compatibility testing with major PC systems and SCSI peripherals

Software Support

The AIC-6260 is supported by both a Bootable BIOS and ASPI Device drivers. ASPI is Adaptec's layered SCSI programming interface offering a standardized interface between the Hardware-Specific Manager and Unique Target Device Drivers.

- System BIOS support available to provide Boot capability, low-level format, power management and support for up to two hard disk drives under DOS without additional software. Custom BIOS support configurations available.
- ASW-1210 DOS ASPI manager with multitasking support for up to 7 SCSI devices
- ASW-210 ASPI SY-TOS for MS-DOS Tape Backup module
- ASW-310 ASPI Sytos Plus for MS-DOS Tape and DAT Backup module
- ASW-410 ASPI CD-ROM for MS-DOS module

Additional Software Support

- ASW-1220 OS/2 ASPI/2 manager — LADDR compatible
- ASW-1240 Novell NetWare 286 and 386 Software Driver
- ASW-1250 SCO UNIX ASPI manager
- ISC Kernal support

Design-In Support

- Design-In kit available containing:
  - AHA-1522 SCSI Host Adapter Evaluation Board
  - ASW-1210 DOS ASPI manager and disk driver
  - ASW-B626 BIOS for AIC-6260
  - Documentation Binder:
    - AIC-6260 Data Book
    - Compatibility Test Report
    - Design-In Schematic
    - Reliability Report
    - Packaging Specs
    - ASPI Interface Document
    - Application Notes
- Field and Factory Technical support

Features

- Single-chip PC/AT Bus-to-SCSI Bus interface
- Simplified programmer-friendly interface
- Powerful SCSI controller automates SCSI Phase Sequencing
- Low cost connectivity to multiple SCSI peripherals
- Compatible with SCSI-2 and Common Command Set (CCS)
- Built-in power management circuitry with software support
- Onboard bus drivers allow direct connect to host AT and SCSI Buses
- Pin-selectable clock source
- High Performance
  - Up to 10 MByte/sec burst transfers on Host Bus
  - Up to 5 MByte/sec synchronous transfers on SCSI Bus
- Comprehensive software support: DOS, OS/2, NetWare 286, NetWare 386, SCO Unix
- System BIOS support
- Supports 8-bit DMA or 16-bit PIO data transfers
- 128-byte data FIFO Buffer for superior host transfer performance

Technical Specifications

Process Technology:	1.2 µm CMOS
Operating Temp. Range:	0°C to 70°C
Storage Temp. Range:	–65°C to 150°C
Operating Voltage Range:	4.75V to 5.25V
Power Consumption:	30 mA (150 mW) Operating @ 20 MHz with external clock 5 mA (25 mW) Powerdown Sleep Mode @ 20 MHz with external clock
Host Bus:	ISA (IBM PC/AT-compatible)
Host Data Trans. Modes:	8/16-bit PIO or 8-bit DMA
Host Transfer Rate:	Up to 10 MBytes/sec Burst
Min. PIO Cycle Time:	200 ns
Min. DMA Cycle Time:	400 ns
Host Data Buffering:	128-byte FIFO
Host Bus Drivers:	Vol = 0.5V max @ 24 mA on SD0-15, DRQ, IRQ, IOCS16 Voh = 2.4V min @ 8 mA on SD0-15, DRQ, IRQ
AT Bus I/O Addr Mapping:	340H or 140H, pin-selectable
Clock Frequency:	Up to 20 MHz internal or external clock, pin-selectable
SCSI Bus Transfer Modes:	8-bit Asynchronous or Synchronous
SCSI Transfer Rate:	Up to 5 MBytes/sec Synchronous
SCSI BUS Drivers:	Vol = 0.5V max @ 48 mA

adaptec, inc., 691 S Milpitas Boulevard, Milpitas, CA 95035 408-945-8600

Adaptec

Advanced Analog

DC/DC Converters

Model	Total Output Power (W)	Output Voltage (V) Current (A)	Input Voltage Range (V)	Number of Outputs	Line & Load regulation	Ripple/noise (DC to 1 MHz)	Temp range	Package
AHE2805S	15	5V,0-3A	17-40	1	+1%	20mV p-p	-55°C to +85°C	A,B
AHE2812S	20	12V,0-1.67A	17-40	1	+1%	30mV p-p		
AHE2815S	20	15V,1.33A	17-40	1	+1%	25mV p-p		
AHE2812D	15	+12V,0-625mA	17-40	2	+1%	25mV p-p		
AHE2815D	15	+15V,0-500mA	17-40	2	+1%	25mV p-p		
AHE2805S/ES	15	5V,0-3A	17-40	1	+1%	20mV p-p	-55°C to +105°C	A,B
AHE2812S/ES	20	12V,0-1.67A	17-40	1	+1%	30mV p-p		
AHE2815S/ES	20	15V,0-1.33A	17-40	1	+1%	30mV p-p		
AHE2812D/ES	15	+12V,0-625mA	17-40	2	+1%	25mV p-p		
AHE2815D/ES	15	+15V,0-500mA	17-40	2	+1%	25mV p-p		
AHE2805S/HB	15	5V,0-3A	17-40	1	+1%	20mV p-p	-55°C to 125°C	A,B
AHE2812S/HB	20	12V,0-1.67A	17-40	1	+1%	30mV p-p		
AHE2815S/HB	20	15V,0-1.33A	17-40	1	+1%	30mV p-p		
AHE2812D/HB	15	+12V,0-625mA	17-40	2	+1%	25mV p-p		
AHE2815D/HB	15	+15V,0-500mA	17-40	2	+1%	25mV p-p		
AHF2805S	12	5V,2.4A	16-40	1	+1%	50mV p-p	-55°C to 125°C	1.450 x 1.120 x .325
AHF2812S	12	12.1A	16-40	1	+1%	50mV p-p		
AHF2815S	12	15V.8A	16-40	1	+1%	50mV p-p		
AHF2812D	12	+12V,.5A	16-40	2	+1%	50mV p-p		
AHF2815D	12	+15V.4A	16-40	2	+1%	50mV p-p		
ALP2805S	15	5V,3A	16-80	1	+1%	20mV p-p	-55°C to 125°C	2.12 x 1.12 x .405
ALP2812S	20	12V,1.67A	16-80	1	+1%	25mV p-p		
ALP2815S	20	15V,1.33A	1	1	+1%	25mV p-p		
ALP2812D	15	+12V,.625A	16-80	2	+1%	25mV p-p		
ALP2815D	15	+15V,.500A	16-80	2	+1%	25mV p-p		
ALP2812T	15	5V,2A	16-80			80mV p-p		1.95 x 1.345 x .495
		+12V,.208A	16-80	3	+1%	30mV p-p		
ALP2815T	15	5V,2A				80mV p-p		
		+15V,.167A	16-80	3	+1%	30mV p-p		
ASR2815D	4	+15V,.133A	16-80	2	+5%	40mV p-p	-55°C to 125°C	1.075 x 1.075 x .350
ASR2815T	4	+15V,.4A			+1%	50mV p-p		
		+15V,.04A	16-80	3	+5%	20mV p-p		
ATW2805S	30	5V,6A	19-40	1	+1.0%	10mV p-p	-55°C to +85°C	C
ATW2812S	30	12V,2.5A	18-40	1	+1.0%	30mV p-p		
ATW2815S	30	15V,2A	18-40	1	+1.0%	30mV p-p		
ATW2812D	30	+12V,2.5A	18-40	2	+1.0%	50mV p-p		
ATW2815D	30	+15V,2A	18-40	2	+1.0%	50mV p-p		
ATW2805S/ES	30	5V,6A	19-40	1	+1.0%	10mV p-p	-55°C to +105°C	C
ATW2812S/ES	30	12V,2.5A	18-40	1	+1.0%	30mV p-p		
ATW2815S/ES	30	15V,2A	18-40	1	+1.0%	30mV p-p		
ATW2812D/ES	30	+12V,2.5A	18-40	2	+1.0%	50mV p-p		
ATW2815D/ES	30	+15V,2A	18-40	2	+1.0%	50mV p-p		
ATW2805S/HB	30	5V,6A	19-40	1	+1.0%	10mV p-p	-55°C to +125°C	C
ATW2812S/HB	30	12V,2.5A	18-40	1	+1.0%	30mV p-p		
ATW2815S/HB	30	15V,2A	18-40	1	+1.0%	30mV p-p		
ATW2812D/HB	30	+12V,2.5A	18-40	2	+1.0%	50mV p-p		
ATW2815D/HB	30	+15V,2A	18-40	2	+1.0%	50mV p-p		
ATO2812T	15	5V,2A	16-40	3	+0.3%	50mV p-p	-55°C to +85°C	C
		+12V,+208mA			+0.5%	25mV p-p		
ATO2815T	15	5V,2A	16-40	3	+0.3%	50mV p-p		
		+15V,+167mA			+0.5%	25mV p-p		
ATO2812T/ES	15	5V,2A	16-40	3	+0.3%	50mV p-p	-55°C to +105°C	D,E
		+12V,+208mA			+0.5%	25mV p-p		
ATO2815T/ES	15	5V,2A	16-40	3	+0.3%	50mV p-p		
		+15V,+167mA			+0/5%	25mV p-p		
ATO2812T/HB	15	5V,2A	16-40	3	+0.3%	50mV p-p	-55°C to +125°C	D,E
		+12V,+208mA			+0.5%	25mV p-p		
ATO2815T/HB	15	5V,2A	16-40	3	+0.3%	50mV p-p		
		+15V,+167mA			+0.5%	25mV p-p		

Video Digital-to-Analog Converters

Bit	Model	Soft Time (ns)	Thruput (MHz)	Lin. Error (Max. L&B)	Analog Output	Input Code	Package
4	RGBDAC3400S	15	60	+1/2	0 to +1	BIN	24/28 pin DIP
4	RGBDAC3405S	15	60	+1/2	0 to +1	BIN	24/28/40 pin DIP
8	VDAC184x	15	40	+1	0 to +1	BIN/CBIN	20/24 pin DIP
8	VDAC185x	8	80	+1	0 to +1	BIN/CBIN	20/24 pin DIP

/ES and /HB devices have optional military screening. 1. Specifications are typical values. Input-to-output isolation @500VDC is 100M minimum. This Series has an industry standard pinout. A cross reference to other manufacturers is available upon request. The /HB devices are a higher temperature device with military screening.

1. Up to 90% of full power is available from either output provided the total output does not exceed 30 watts.

Package

A. Standard - 2.12 x 1.12 x 0.495
B. Flange - 2.89 x 1.12 x 0.495
C. 2.700 x 1.345 x 0.500
D. standard - 1.950 x 1.345 x 0.500
E. flange - 2.700 x 1.345 x 0.500

An optional EMI filter will reduce the input ripple current to levels below the limits imposed by Condition CEO3 of MIL-STD-461B.

The AF461 Series has 1.75 or 3.8 amp max. input current.

Our new AFW Series (50 watt converter) will be available in January 1992.

Standard military drawings are available on most products.

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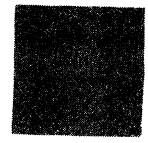

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ANALOG DEVICES

The pages that follow in IC Master are excerpts from the *1992 Analog Devices Short Form Designers' Guide.* Entries contain selection guides to all of our product lines with key specifications that will lead you quickly to the optimum device for each application. This Designers' Guide is a companion to our four comprehensive Reference Manuals on Data Conversion Products (two Volumes), Audio/Video Products, and Linear Products. Listed below are summaries of the product areas covered in each Reference Manual.

Databooks are available free of charge from your nearest Analog Devices sales office or from the Analog Devices Literature Distribution Center at (1-800) 262-5643 (U.S.A. only) or (617) 329-4700, Ext. 3392.

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Voltage References
Data Acquisition Subsystems
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Application Specific ICs
Power Supplies

AUDIO/VIDEO PRODUCTS REFERENCE MANUAL
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Video A/D Converters
Audio D/A Converters
Video D/A Converters
Special Function Audio Products
Special Function Video Products
Digital Signal Processing Products
Application Notes

LINEAR PRODUCTS DATABOOK
Operational Amplifiers
Comparators
Instrumentation Amplifiers
Isolation Amplifiers
Analog Multipliers/Dividers
Log/Antilog Amplifiers
RMS-to-DC Converters
Mass Storage Components
ATE Components
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General Introduction

When contacting suppliers, say you saw it in IC MASTER

Analog Devices designs, manufactures and sells worldwide sophisticated electronic components and subsystems for use in real-world signal processing. More than six hundred standard products are produced in manufacturing facilities located throughout the world. These facilities encompass all relevant technologies, including several embodiments of CMOS, BiMOS, bipolar and hybrid integrated circuits, each optimized for specific attributes—and assembled products in the form of potted modules, printed-circuit boards and instrument packages.

State-of-the-art technologies have been utilized (and in many cases invented) to provide timely, reliable, easy-to-use advanced designs at realistic prices. Our popular IC products are available in both conventional and surface mount packages (SOIC, LCC, PLCC), and many of our assembled products employ surface mount technology to reduce manufacturing costs and overall size. A quarter century of successful applications experience and continuing vertical integration insure that these products are oriented to user needs. The ongoing application of today's state-of-the-art and the invention of tomorrow's state-of-the-art processes strengthen the leadership position of Analog Devices in standard data acquisition and signal processing products and make us a strong contender in high performance, mixed-signal ASICs.

NEW PRODUCTS FOR 1992

Analog Devices has made significant investments in the past few years to develop major new process and design technologies which have allowed us to expand our product lines extensively into many new areas such as video displays, digital audio, disk drive data retrieval, automotive, and telecommunications. These new capabilities have also allowed us to offer higher performance and lower cost products in our traditional data acquisition and signal processing lines. They are all classified and summarized in this Guide, along with existing products which are suitable for new designs. New products will be marked with an "*" in the listings.

The primary thrust for new products is in the very high speed and video areas with fast new DACs, ADCs and amplifiers directed primarily at display, signal processing, radar, ATE, disk drive, communications and automotive applications. Our DSP offerings have been enhanced greatly by the ADSP-21020 floating-point processor. Automotive products like the AD22001 lamp monitor are already in production in automobiles, while the new ADXL50 micromachined accelerometer is a breakthrough for airbag systems and active suspension.

TECHNICAL SUPPORT

Our extensive technical literature discusses the technology and applications of products for precision measurement and control and dynamic signal processing. In addition to tutorial material and comprehensive data sheets, we offer application notes, application guides, technical handbooks and several serial publications; for example, *Analog Productlog* provides brief information on new products being introduced, and *Analog Dialogue*, our technical magazine, provides in-depth discussions of new developments in analog and digital circuit technology as applied to data acquisition, signal processing, control and test. In addition to the Reference Manuals and general short form selection guides such as this one, we also publish several short form catalogs on specific product families. Analog Devices also provides in-depth technical support through our sales offices and with a network of applications engineers available at our factory locations to discuss our products and your applications. A call to our central office in Norwood, Massachusetts will be directed to the engineer most closely associated with your interests.

SALES OFFICES

Backing up our design and manufacturing capabilities and our extensive array of publications is a network of sales offices, representatives and distributors throughout the United States and most of the world. They are staffed by experienced sales and applications engineers, and many of them maintain a local stock of Analog Devices products. Our Worldwide Sales Directory, as of the publication date, appears on the last two pages of this section.

RELIABILITY

The manufacture of reliable products is a key objective at Analog Devices. The primary focus is the company-wide Quality Improvement Process (QIP). In addition, we maintain facilities that have been qualified under such standards as MIL-M-38510 (Class B and Class S) for ICs in the U.S. and MIL-STD-1772 for hybrids. Many of our products—both proprietary and second-source—have qualified for JAN part numbers; others are in the process. A larger number of products—including many of the newer ones just starting the JAN qualification process—are specifically characterized on Standard Military Drawings (SMDs). Most of our ICs are available in versions that comply with MIL-STD-883C Class B, and many also comply with Class S. We publish a *Military Products Databook* for designers who specify ICs and hybrids for military contracts. The 1990 issue consists of two volumes with data on 343 product families; the 120 entries in the second of those volumes describe qualified products manufactured by our PMI Division. A newsletter, *Analog Briefings*®, provides current information about the status of reliability at ADI.

Our PLUS program makes available standard devices (commercial and industrial grades, plastic or ceramic packaging) for *any* user with demanding application environments. Subjected to stringent screening, similar to MIL-STD-883 test methods, these devices are suffixed "/+" and are available from stock.

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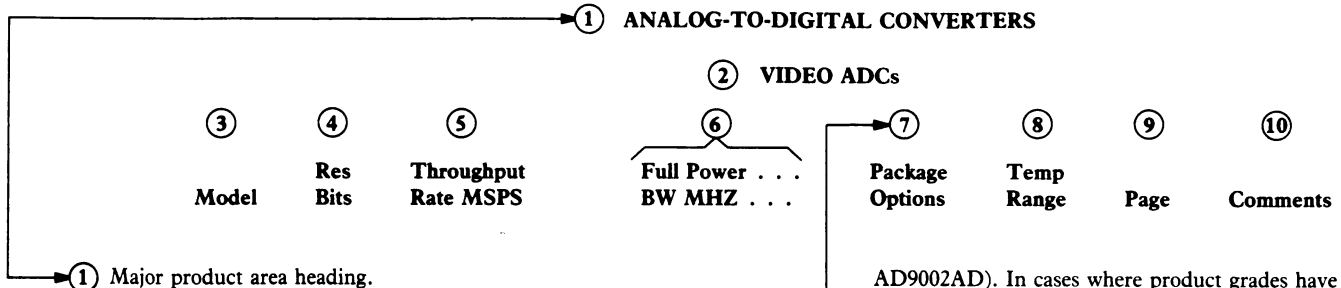
Selection Guide Organization (Example)



(1) Major product area heading.

(2) Secondary product area heading (a product may be found in more than one area).

(3) Generic part number (without suffixes for performance grades or packages).

(4) Primary specification (first sort criterion).

(5) Secondary sort specification.

(6) Other key specifications. All specifications are min or max unless noted as typical.

(7) Package options—product available in these package styles.

(8) Temperature ranges available—C = Commercial 0 to +70°C; I = Industrial −40°C to +85°C (some products −25°C to +85°C); M = Military −55°C to +125°C.

(9) Page—Letter designation indicates the appropriate product databook in which complete data sheet information can be found. CI = *Data Converter Reference Manual, Volume I*; CII = *Data Converter Reference Manual, Volume II*; L = *Linear Products Databook*; and P = *Precision Monolithics Division Databook*. D = design-in products not contained in databooks, but data sheets are available. Contact your nearest sales office for data sheets on any of the above.

(10) Additional comments on features or applications.

Note that products are listed by generic part number only, such as AD9002, without additional suffixes for performance grade and package style (e.g., AD9002AD). In cases where product grades have differing values for a given specification, the range for all grades is given. The individual product data sheets provide the detail specifications on the actual models available, as well as complete ordering information.

PACKAGE OPTIONS

1 Hermetic DIP, Ceramic or Metal
2 Plastic or Epoxy Sealed DIP
3 Cerdip
4 Ceramic Leadless Chip Carrier
5 Plastic Leaded Chip Carrier
6 Small Outline "SOIC" Package
7 Hermetic Metal Can
8 Hermetic Metal Can DIP
9 Ceramic Flatpack
10 Plastic Quad Flatpack
11 Single-in-Line "SIP" Package
12 Ceramic Leaded Chip Carrier
13 Nonhermetic Ceramic/Glass DIP
14 J-Leaded Ceramic Package
15 Ceramic Pin Grid Array
16 TO-92
17 Plastic Pin Grid Array

BOLDFACE TYPE

Boldface entries indicate products recommended for new design.

ASTERISK

*Denotes new product since the publication of the most recent Databook.

Digital-to-Analog Converters

Single DACs, Current Output

Model	Res Bits	Settling Time µs typ	Bus Interface Bits[1]	Reference Volt Int/Ext (M)[2]	Package Options	Temp Range	Page	Comments
AD9768	**8**	**0.005**	**8, µP**	**−1.26 V, Int**	**1, 4**	**C, M**	**C I**	**Ultrahigh Speed, ECL Compatible, 20 mA Output Current**
DAC-08	**8**	**0.085**	**8**	**Ext (M)**	**2, 3, 4, 6**	**C, I, M**	**C I**	**8-Bit High Speed Multiplying DAC**
DAC-20	8	0.085	8	10 V, Ext	2, 3	C	C I	2-Digit BCD High Speed Multiplying DAC
PM-7524	**8**	**0.10**	**8, µP**	**Ext (M)**	**2, 3, 4, 5, 6**	**C, I, M**	**C I**	**CMOS, Low Cost, 8-Bit Multiplying DAC with Latch**
AD7524	**8**	**0.10**	**8, µP**	**Ext (M)**	**2, 3, 4, 5, 6**	**C, I, M**	**C I**	**CMOS, Low Cost, 8-Bit Multiplying DAC with Latch**
DAC-1408A	8	0.25	8	Ext (M)	2, 3, 6	C, I	C I	8-Bit Multiplying DAC
DAC-1508A	8	0.25	8	Ext (M)	3	M	C I	8-Bit Multiplying DAC
DAC-888	8	0.30	8, µP	Ext (M)	3	I, M	C I	BYTEDAC 8-Bit High Speed Multiplying DAC
AD9720	**10**	**0.005**	**10**	**Int**	**2, 3, 5, 14**	**C, M**	**C I**	**Ultrahigh Speed, ECL Compatible, Low Power, Low Glitch**
AD9721	**10**	**0.005**	**10**	**Int**	**2, 3, 5, 14**	**C, M**	**C I**	**Ultrahigh Speed, TTL Compatible, Low Power, Low Glitch**
DAC-10	**10**	**0.085**	**10**	**Ext (M)**	**2, 3, 6**	**C, M**	**C I**	**10-Bit High Speed Multiplying DAC**
AD561	**10**	**0.25**	**10**	**Int**	**1, 2**	**C, M**	**C I**	**Industry Standard 10-Bit DAC, JAN Part Available**
DAC-100	10	0.300	10	6.6 V, Int	3	C, I, M	C I	10-Bit Current Output DAC
DAC-86	10	0.500	10	Ext (M)	3	I	C I	COMDAC Companding DAC (U-255 Law)
DAC-88	10	0.500	10	Ext (M)	3	I	C I	COMDAC Companding DAC (U-255 Law)
DAC-89	10	0.500	10	Ext (M)	3	I	C I	COMDAC Companding DAC (A-Law)
PM-7533	10	0.60	10	Ext (M)	2, 3, 5, 6	C, I, M	C I	CMOS, Low Cost, 10-Bit Multiplying DAC
AD7533	10	0.60	10	Ext (M)	2, 3, 4, 5, 6	C, I, M	C I	CMOS, Low Cost, 10-Bit Multiplying DAC
AD9712A	**12**	**0.022**	**12**	**Int**	**2, 3, 5, 14**	**C, M**	**C I**	**ECL Compatible, Low Glitch, 0.5 LSB DNL Typ**
AD9713A	**12**	**0.027**	**12**	**Int**	**2, 3, 5, 14**	**C, M**	**C I**	**TTL Compatible, Low Glitch, 0.5 LSB DNL Typ**
AD9712	12	0.030	12	−1.2 V, Int	2, 5	C, M	C I	ECL Compatible Inputs, Low Glitch
AD9713	12	0.030	12	−1.2 V, Int	2, 5	C, M	C I	TTL Compatible Inputs, Low Glitch
AD568	**12**	**0.035**	**12**	**Int**	**3, 4**	**C, M**	**C I**	**Highest Accuracy 12-Bit Ultrahigh Speed DAC**
AD668	**12**	**0.05**	**12**	**Ext (M)**	**3**	**C, M**	**C I**	**Multiplying 12-Bit Ultrahigh Speed DAC**
AD565A	**12**	**0.25**	**12**	**10 V, Int**	**1**	**C, M**	**C I**	**Industry Workhorse High Speed, JAN Part Available**
DAC-8043	**12**	**0.25**	**Serial, µP**	**Ext (M)**	**2, 3**	**C, I, M**	**C I**	**8-Pin Serial Input 12-Bit CMOS Multiplying DAC**
PM-7542	**12**	**0.25**	**4, µP**	**Ext (M)**	**2, 3, 4, 6**	**C, I, M**	**C I**	**CMOS, Nibble Load 12-Bit Multiplying DAC**
AD7542	**12**	**0.25**	**4, µP**	**Ext (M)**	**1, 2, 3, 4, 5**	**C, I, M**	**C I**	**CMOS, Nibble Load 12-Bit Multiplying DAC**
***PM-6012**	**12**	**0.25**	**12**	**Ext (M)**	**2, 3, 6**	**I**	**C I**	**Low Cost, High Speed 12-Bit Multiplying DAC**
DAC-312	**12**	**0.25**	**12**	**Ext (M)**	**2, 3, 6**	**C, M**	**C I**	**12-Bit High Speed Multiplying DAC**
AD DAC80-I	12	0.30	12	6.3 V, Int	1	C	C I	Industry Standard, High Speed DAC
AD DAC85-I	12	0.30	12	6.3 V, Int	1	I, M	C I	Improved Industry Standard, High Speed DAC
AD DAC87-I	12	0.30	12	6.3 V, Int	1	I, M	C I	Improved Industry Standard, High Speed DAC
AD566A	**12**	**0.35**	**12**	**10 V, Ext**	**1**	**C, M**	**C I**	**High Speed DAC**
AD7543	**12**	**0.35**	**Serial, µP**	**Ext (M)**	**1, 2, 3, 4, 5, 6**	**C, I, M**	**C I**	**CMOS, Serial Load 12-Bit Multiplying DAC**
DAC-8143	**12**	**0.38**	**Serial, µP**	**Ext (M)**	**2, 3, 6**	**I, M**	**C I**	**12-Bit Serial Input DAC**
PM-7543	**12**	**0.38**	**Serial, µP**	**Ext (M)**	**2, 3, 5, 6**	**C, I, M**	**C I**	**CMOS, Serial Load 12-Bit Multiplying DAC, Daisy Chain**
PM-7541A	**12**	**0.60**	**12**	**Ext (M)**	**2, 3, 4, 5, 6**	**C, I, M**	**C I**	**CMOS, 12-Bit Multiplying DAC**
AD7541A	**12**	**0.60**	**12**	**Ext (M)**	**2, 3, 4, 5**	**C, I, M**	**C I**	**CMOS, 12-Bit Multiplying DAC**

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Model	Res Bits	Settling Time µs typ	Bus Interface Bits[1]	Reference Volt Int/Ext (M)[2]	Package Options	Temp Range	Page	Comments
DAC-8012	**12**	**1.0**	**12, µP**	**Ext (M)**	**2, 3, 5**	**C, I, M**	**C I**	**12-Bit CMOS DAC with Memory and Readback**
PM-7548	**12**	**1.0**	**8, µP**	**Ext (M)**	**2, 3, 5, 6**	**C, I, M**	**C I**	**CMOS, Byte Load 12-Bit DAC, Single or Dual Supply**
AD7548	**12**	**1.0**	**8, µP**	**Ext (M)**	**2, 3, 4, 5, 6**	**C, I, M**	**C I**	**CMOS, Byte Load 12-Bit DAC, Single or Dual Supply**
AD562	12	1.5	12	Ext	1	C, I, M	C I	Industry Standard, JAN Part Available
AD563	12	1.5	12	2.5 V, Int	1	C, M	C I	Industry Standard
AD7545A	**12**	**1.0**	**12, µP**	**Ext (M)**	**2, 3, 4, 5**	**C, I, M**	**C I**	**CMOS, Improved AD7545**
PM-7545	**12**	**1.0**	**12, µP**	**Ext (M)**	**2, 3, 4, 5, 6**	**C, I, M**	**C I**	**CMOS, Parallel Load 12-Bit Multiplying DAC**
PM-7645	**12**	**1.0**	**12, µP**	**Ext (M)**	**2, 3, 4**	**C, I, M**	**C I**	**PM-7545 Specified for +15 V Operation**
AD7545	**12**	**2.0**	**12, µP**	**Ext (M)**	**2, 3, 4, 5**	**C, I, M**	**C I**	**CMOS, Parallel Load 12-Bit Multiplying DAC**
AD7534	**14**	**1.5**	**8, µP**	**Ext (M)**	**2, 3, 5**	**C, I, M**	**C I**	**CMOS, Byte Load**
AD7535	**14**	**1.5**	**8/14, µP**	**Ext (M)**	**2, 3, 4, 5**	**C, I, M**	**C I**	**CMOS, Parallel or Byte Load**
AD7536	**14**	**1.5**	**8/14, µP**	**Ext (M)**	**2, 3, 4, 5**	**C, I, M**	**C I**	**CMOS, Parallel or Byte Load, Bipolar Output**
AD7538	**14**	**1.5**	**14, µP**	**Ext (M)**	**2, 3, 6**	**C, I, M**	**C I**	**CMOS, Parallel Load**
***AD1851**	**16**	**0.35**	**Serial, µP**	**Int**	**2, 6**	**C**	**C I**	**16-Bit 16 × F_S PCM Audio DAC**
AD1856	**16**	**0.35**	**Serial, µP**	**Int**	**2, 6**	**C**	**C I**	**16-Bit PCM Audio DAC**
***DAC-16**	**16**	**0.5**	**16**	**Ext (M)**	**1, 2**	**I, M**	**C I**	**16-Bit High Speed Multiplying DAC**
AD DAC71-I	16	1.0	16	6.3 V, Int	1, 7	C	C I	High Resolution 16-Bit DAC
AD DAC72-I	16	1.0	16	6.3 V, Int	1, 7	C, I	C I	High Resolution 16-Bit DAC
AD1860	**18**	**0.35**	**Serial, µP**	**Int**	**2, 6**	**C**	**C I**	**18-Bit PCM Audio DAC**
***AD1861**	**18**	**0.35**	**Serial, µP**	**Int**	**2, 6**	**C**	**C I**	**18-Bit 16 × F_S PCM Audio DAC**
***AD1862**	**20**	**0.35**	**Serial, µP**	**Int**	**2**	**C**	**C I**	**20-Bit Audio DAC**

[1]This column lists the data format for the bus with "µP" indicating microprocessor capability—i.e., for a 12-bit converter 8/12, µP indicates that the data can be formatted for an 8-bit bus or can be in parallel (12 bits) and is microprocessor compatible.

[2]Ext indicates external reference with the range of voltages listed where applicable. Ext (M) indicates external reference with multiplying capability. Int indicates reference is internal. A voltage value is given if the reference is pinned out.

Boldface Type: Product recommended for new design.

*New product.

Digital-to-Analog Converters

Single DACs, Voltage Output

Model	Res Bits	Settling Time µs typ	Bus Interface Bits[1]	Reference Volt Int/Ext (M)[2]	Package Options	Temp Range	Page	Comments
AD557	**8**	**0.8**	**8, µP**	**Int**	**2, 5**	**C**	**C I**	**Lowest Cost 8-Bit DACPORT™; Single +5 V Supply**
AD7569	**8**	**1.0**	**8, µP**	**Int**	**2, 3, 4, 5, 6**	**C, I, M**	**C II**	**CMOS, Complete 8-Bit DAC/ADC/SHA/ Reference**
AD558	**8**	**3.0**	**8, µP**	**Int**	**1, 2, 4, 5**	**C, M**	**C I**	**10 V Out DACPORT, Single or Dual Supply**
***PM7224**	**8**	**5.0**	**8, µP**	**2–12.5 V, Ext**	**2, 3, 4, 5, 6**	**C, I, M**	**C I**	**CMOS, Low Cost 8-Bit DAC**
AD7224	**8**	**5.0 (max)**	**8, µP**	**2–12.5 V, Ext**	**2, 3, 4, 5, 6**	**C, I, M**	**C I**	**CMOS, Low Cost 8-Bit DAC**
DAC-06	10	1.5	10	6.7 V, Int	1	C, M	C I	Twos Complement Input Coding
DAC-210	10	1.5	10	7.6 V, Int	1	C, I	C I	Sign-Magnitude/Internal Reference
DAC-05	10	2.0	10	6.7 V, Int	1	C, M	C I	Sign-Magnitude for Unipolar Output
DAC-02	10	2.0	10	6.7 V, Int	1	C, M	C I	Sign-Magnitude/Bipolar Output
AD7848	**12**	**2.5**	**12, µP**	**Int (+3 V), Ext**	**2, 3, 5**	**C, I**	**C I**	**CMOS, Complete 12-Bit DAC with 8-Word FIFO**
AD7845	**12**	**2.5**	**12, µP**	**Ext (M)**	**2, 3, 4, 5, 6**	**C, I, M**	**C I**	**CMOS, 12-Bit Multiplying DAC with Output Amplifier**
AD DAC80-V	12	3.0	12	6.3 V, Int	1	C	C I	Improved Industry Standard
AD DAC85-V	12	3.0	12	6.3 V, Int	1	I, M	C I	Improved Industry Standard
AD DAC87-V	12	3.0	12	6.3 V, Int	1	I, M	C I	Improved Industry Standard
AD667	**12**	**3.0**	**4/8/12, µP**	**10 V, Int**	**1, 2, 4, 5**	**C, I, M**	**C I**	**Highest Accuracy Complete 12-Bit DAC**
AD767	**12**	**3.0**	**12, µP**	**10 V, Int**	**1, 2**	**C, I, M**	**C I**	**Fastest Interface Complete 12-Bit DAC**
AD7233	**12**	**10 (max)**	**Serial, µP**	**Int**	**2**	**I**	**C I**	**Smallest 12-Bit Serial DACPORT (8-Pin) Bipolar ±5 V Output Range**
***AD7243**	**12**	**10 (max)**	**Serial**	**Int (+5 V), Ext**	**2, 3, 6**	**I, M**	**C I**	**Low Cost 12-Bit Serial DACPORT in 16-Pin Package**
AD7245A	**12**	**10 (max)**	**12, µP**	**5 V, Int**	**2, 3, 4, 5, 6**	**C, I, M**	**C I**	**Faster Interface, 12 V and 15 V AD7245**
AD7248A	**12**	**10 (max)**	**8, µP**	**5 V, Int**	**2, 3, 5, 6**	**C, I, M**	**C I**	**Faster Interface, 12 V and 15 V AD7248**
AD7245	12	10 (max)	12, µP	5 V, Int	2, 3, 4, 5	C, I, M	C I	CMOS, 12-Bit Complete DAC, Parallel Load
AD7248	12	10 (max)	8, µP	5 V, Int	2, 3, 4, 5	C, I, M	C I	CMOS, 12-Bit Complete DAC, Byte Load
AD7840	**14**	**2.0**	**14/Serial, µP**	**Int (+3 V), Ext**	**2, 3, 5**	**C, I, M**	**C I**	**CMOS, 14-Bit Complete DAC, Parallel or Serial Load**
***AD766**	**16**	**1.5**	**Serial, µP**	**Int**	**1, 2**	**C, I, M**	**C I**	**Zero-Chip Interface 16-Bit DSP DACPORT**
***AD1851**	**16**	**1.5**	**Serial µP**	**Int**	**2, 6**	**C**	**C I**	**16-Bit, 16 × F_S PCM Audio DAC**
AD1856	**16**	**1.5**	**Serial, µP**	**Int**	**2, 6**	**C**	**C I**	**16-Bit PCM Audio DAC**
AD569	**16**	**3.0**	**8/16, µP**	**±5 V, Ext (M)**	**1, 2**	**I, M**	**C I**	**Monolithic, 16-Bit Monotonic DAC**
AD DAC71-V	16	5.0	16	6.3 V, Int	1, 7	C	C I	High Resolution 16-Bit DAC
AD DAC72-V	16	5.0	16	6.3 V, Int	1, 7	C, I	C I	High Resolution 16-Bit DAC
AD7846	**16**	**6**	**16, µP**	**Ext (M)**	**1, 2, 4, 5**	**C, I, M**	**C I**	**CMOS, 16-Bit Multiplying DAC with Readback Capability**
***AD669**	**16**	**8**	**16, µP**	**10 V, Int**	**2, 3, 6**	**I, M**	**C I**	**Monolithic, Complete 16-Bit DAC**
DAC1136	**16**	**8**	**16**	**6 V, Int**	**Module**	**C**	**C I**	**High Resolution and Accuracy**
AD1147	**16**	**20**	**16, µP**	**10 V, Int**	**2**	**I**	**C I**	**Internal 8-Bit Latched Input DACs for Offset and Gain Adjust**
AD1148	**16**	**20**	**16, µP**	**10 V, Int**	**2**	**I**	**C I**	**Separate 8-Bit Bus for Internal Offset and Gain Adjust DACs**

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Model	Res Bits	Settling Time µs typ	Bus Interface Bits[1]	Reference Volt Int/Ext (M)[2]	Package Options	Temp Range	Page	Comments
AD1860	**18**	**1.5**	**Serial, µP**	**Int**	**2, 6**	**C**	**C I**	**18-Bit PCM Audio DAC**
***AD1861**	**18**	**1.5**	**Serial, µP**	**Int**	**2, 6**	**C**	**C I**	**18-Bit, 16 × F_S PCM Audio DAC**
DAC1138	18	10	18	6 V, Int	Module	C	C I	High Resolution and Accuracy
AD1139	**18**	**40**	**18, µP**	**–10 V, Int**	**1**	**C**	**C I**	**True 18-Bit Accuracy**

Video Graphics DACs

Model	Res Bits	Rate Update Rate MHz min	Palette Size	Reference	Package Options	Temp Range	Page	Comments
ADV476	**6**	**66, 50, 35**	**256**	**I**	**2, 5**	**C**	**C I**	**CMOS, Triple 6-Bit Color Palette RAM-DAC**
***ADV7146**	**6/8**	**66, 50, 35**	**256**	**I**	**2, 5**	**C**	**C I**	**Pin Compatible to ADV476, INMOS 171/176 with CEG**
ADV471	**6**	**80, 66, 50, 35**	**256**	**V/I**	**5**	**C**	**C I**	**CMOS, Triple 6-Bit Color Palette RAM-DAC**
***ADV7141**	**6/8**	**80, 66, 50, 35**	**256**	**V/I**	**2, 5**	**C**	**C I**	**Pin Compatible to ADV471 with CEG**
***ADV477/ADV475**	**6/8**	**80, 66, 50, 35**	**256**	**V (Int.)**	**2, 5**	**C**	**C I**	**Low Power, Power Down RAM-DAC**
ADV476	**6**	**80, 66, 50, 35**	**256**	**V (Int.)**	**2, 5**	**C**	**C I**	**Low Power, Power Down RAM-DAC**
ADV478	**6/8**	**80, 66, 50, 35**	**256**	**V/I**	**5**	**C**	**C I**	**CMOS, Triple 8-Bit Color Palette RAM-DAC**
***ADV7148**	**6/8**	**80, 66, 50, 35**	**256**	**V/I**	**2, 5**	**C**	**C I**	**Pin Compatible to ADV478 with CEG**
ADV453	**8**	**66, 40**	**256**	**V**	**2, 5**	**C**	**C I**	**CMOS, Triple 8-Bit Color Palette RAM-DAC**
***ADV473**	**8**	**100, 80, 66, 50, 35**	**256**	**V/I (Int.)**	**5**	**C**	**C I**	**True-Color Video RAM-DAC (Triple 8-Bit)**
***ADV101**	**8**	**80, 50, 30**	**—**	**V**	**2, 5**	**C**	**C I**	**CMOS, Triple 8-Bit Video DAC**
ADV7120	**8**	**80, 50, 30**	**—**	**V**	**2, 5**	**C**	**C I**	**CMOS, Triple 8-Bit Video DAC**
AD9701	**8**	**225**	**—**	**—**	**1, 3, 4**	**I, M**	**C I**	**Single 8-Bit Video DAC**
ADV7121	**10**	**80, 50, 30**	**—**	**V**	**2, 5**	**C**	**C I**	**CMOS, Triple 10-Bit Video DAC**
ADV7122	**10**	**80, 50, 30**	**—**	**V**	**2, 5**	**C**	**C I**	**CMOS, Triple 10-Bit Video DAC**
***ADV7150**	**10**	**170, 135, 110, 85**	**256**	**V**	**10**	**C**	**C I**	**High Speed, True-Color Video RAM-DAC, (Triple 10-Bit) 4 × 1 Multiplexing**
***ADV7151**	**10**	**170, 135, 110, 85**	**256**	**V**	**10**	**C**	**C I**	**High Speed, Pseudo-Color Video RAM-DAC, (Triple 10-Bit)**
***ADV7152**	**10**	**170, 135, 110, 85**	**256**	**V**	**10**	**C**	**C I**	**High Speed, Pseudo-Color Video RAM-DAC, (Triple 10-Bit) 2 × 1 Multiplexing**

[1]This column lists the data format for the bus with "µP" indicating microprocessor capability—i.e., for a 12-bit converter 8/12, µP indicates that the data can be formatted for an 8-bit bus or can be in parallel (12 bits) and is microprocessor compatible.

[2]Ext indicates external reference with the range of voltages listed where applicable. Ext (M) indicates external reference with multiplying capability. Int indicates reference is internal. A voltage value is given if the reference is pinned out.

Boldface type: Product recommended for new design.

*New product.

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Digital-to-Analog Converters

Multiple DACs, Voltage Output

Model	Res Bits	Settling Time µs typ	Bus Interface Bits[1]	Reference Voltage Int/Ext[2]	# of DACs	Package Options	Temp Range	Page	Comments
AD7669	**8**	**1.0**	**8, µP**	**Int**	**2**	**2, 5, 6**	**C, I, M**	**C II**	**CMOS, Complete 8-Bit Dual DAC/ADC/SHA/Reference**
DAC-8228	**8**	**2.0**	**8, µP**	**Ext (M)**	**2**	**2, 3, 6**	**I, M**	**C I**	**CMOS, PM-7528 Pinout with Voltage Output**
DAC-8229	**8**	**2.0**	**8, µP**	**Ext (M)**	**2**	**2, 3, 6**	**I, M**	**C I**	**CMOS, Single or Dual Supply Operation**
AD7769	**8**	**2.5**	**8, µP**	**Ext**	**2**	**2, 5**	**C, I**	**C II**	**CMOS, Complete 8-Bit Dual DAC/ 2-Channel ADC**
DAC-8426	**8**	**3.0**	**8, µP**	**10 V, Int**	**4**	**2, 3, 6**	**I, M**	**C I**	**CMOS, Complete with 10 V Reference, Improved Timing**
PM-7226A	**8**	**3.0**	**8, µP**	**Ext (M)**	**4**	**2, 3, 6**	**I, M**	**C I**	**CMOS, Improved Timing, Specified for +5 V to +15 V Operation**
AD7226	**8**	**3.0**	**8, µP**	**2–12.5 V, Ext**	**8**	**2, 3, 4, 5, 6**	**C, I, M**	**C I**	**CMOS, No User Trims, Specified with Single or Dual Supplies**
AD7225	**8**	**5.0 (max)**	**8, µP**	**2–12.5 V, Ext**	**4**	**2, 3, 4, 5, 6**	**C, I, M**	**C I**	**CMOS, Separate References for Each DAC**
DAC-8800	**8**	**0.8**	**8, Serial**	**DC, Ext**	**8**	**2, 3, 6**	**C, I, M**	**C I**	**Octal 8-Bit CMOS DAC (TrimDAC™)**
DAC-8840	**8**	**3.5**	**Serial**	**Ext (M)**	**8**	**2, 3, 6**	**I, M**	**C I**	**CMOS, Four-Quadrant Multiplying with Op Amps**
***DAC-8841**	**8**	**3.5**	**Serial**	**Ext (M)**	**8**	**2, 3, 6**	**I, M**	**C I**	**Octal 8-Bit, Two Quadrant, Multiplying TrimDAC, +5 V Operation**
AD7228	8	5.0 (max)	8, µP	2–10 V, Ext	8	2, 3, 4, 5, 6	C, I, M	C I	CMOS, Specified for Single or Dual Supply, Skinny 20-Pin DIP
***AD7228A**	**8**	**5.0 (max)**	**8, µP**	**2–10 V, Ext**	**8**	**2, 3, 5, 6**	**C, I, M**	**C I**	**CMOS, Specified for Single or Dual Supply, Skinny 20-Pin DIP**
AD75004	**12**	**2**	**12, µP**	**5 V, Int**	**4**	**2, 5**	**C**	**C I**	**Fastest Quad 12-Bit Voltage Output DAC**
***AD7242**	**12**	**2**	**Serial, µP**	**3 V, Int**	**2**	**2, 3, 6**	**C, I**	**C I**	**Complete ±5 V 12-Bit Dual DAC**
AD392	12	4	12, µP	Int	4	8	C	C I	Fast Bus Access Time (<40 ns), Data Readback Capability
AD390	**12**	**4**	**12, µP**	**10 V, Int**	**4**	**1**	**C, M**	**C I**	**Double Buffered, Simultaneous Update**
***AD7837**	**12**	**5**	**8, µP**	**Ext (M)**	**2**	**2, 3, 6**	**C, I, M**	**C I**	**CMOS, MDAC, Byte Load, Double Buffered**
***AD7847**	**12**	**5**	**12, µP**	**Ext (M)**	**2**	**2, 3, 6**	**C, I, M**	**C I**	**CMOS MDAC, Parallel Load**
DAC-8412	**12**	**6**	**12, µP**	**Ext**	**4**	**1, 2, 4, 5**	**I, M**	**C I**	**Readback, Reset to Midscale, Low Power Quad DAC, +5 V to ±15 V Operation**
***DAC-8413**	**12**	**6**	**12, µP**	**Ext**	**4**	**1, 2, 4, 5**	**I, M**	**C I**	**Equivalent to DAC-8412 with Reset to Zero Scale**

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Model	Res Bits	Settling Time µs typ	Bus Interface Bits[1]	Reference Voltage Int/Ext[2]	# of DACs	Package Options	Temp Range	Page	Comments
***AD7850**	**12**	**8**	**12, µP**	**5 V, Int**	**8**	**5**	**C, I**	**C I**	**Monolithic Octal 12-Bit Voltage Output DAC**
AD7237	**12**	**10 (max)**	**8, µP**	**Int (+5 V), Ext**	**2**	**2, 3, 6**	**C, I, M**	**C I**	**CMOS, Complete 12-Bit Dual DAC, Byte Load**
AD7247	**12**	**10 (max)**	**12, µP**	**Int (+5 V), Ext**	**2**	**2, 3, 6**	**C, I, M**	**C I**	**CMOS, Complete 12-Bit Dual DAC, Parallel Load**
AD664	**12**	**10**	**12, µP**	**Ext (M)**	**4**	**1, 2, 4, 5**	**C, I, M**	**C I**	**Readback, Reset, Low Power Quad DAC**
AD394	**12**	**10**	**12, µP**	**Ext (M)**	**4**	**1**	**C, M**	**C I**	**Four Independent Reference Inputs, Bipolar Outputs**
AD395	**12**	**10**	**12, µP**	**Ext (M)**	**4**	**1**	**C, M**	**C I**	**Four Independent Reference Inputs, Unipolar Outputs**
***AD7244**	**14**	**2**	**Serial, µP**	**+3 V, Int**	**2**	**2, 3, 6**	**C, I, M**	**C I**	**Complete ±5 V 14-Bit Dual DAC**
AD396	14	10	8, µP	Ext (M)	4	1	C, M	C I	Four Independent Reference Inputs, **Bipolar Output, Simultaneous Update**
***AD1866**	**16**		**Serial**	**Int**	**2**	**2, 6**	**I**	**C I**	**Dual 16-Bit Audio DAC, +5 V Single Supply**
***AD1864**	**18**	**1.5**	**Serial, µP**	**Int**	**2**	**2, 5**	**C**	**C I**	**Dual 18-Bit Audio DAC**
***AD1865**	**18**	**1.5**	**Serial, µP**	**Int**	**2**	**2**	**C**	**C I**	**Dual 18-Bit, 16 × F_S PCM Audio DAC**
***AD1868**	**18**	**1.5**	**Serial, µP**	**Int**	**2**	**2, 6**	**C**	**C I**	**Dual 18-Bit Audio DAC, +5 V Single Supply**

[1]This column lists the data format for the bus with "µP" indicating microprocessor capability—i.e., for a 12-bit converter 8/12, µP indicates that the data can be formatted for an 8-bit bus or can be in parallel (12 bits) and is microprocessor compatible.

[2]Ext indicates external reference with the range of voltages listed where applicable. Ext (M) indicates external reference with multiplying capability. Int indicates reference is internal. A voltage value is given if the reference is pinned out.

Boldface type: Product recommended for new design.

*New product.

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Digital-to-Analog Converters

Multiple DACs, Current Output

Model	Res Bits	Settling Time µs typ	Bus Interface Bits[1]	Reference Voltage Int/Ext[2]	# of DACs	Package Options	Temp Range	Page	Comments
PM7528	8	0.18	8, µP	Ext (M)	2	2, 3, 4, 5, 6	C, I, M	C I	CMOS, Single Supply Operation, TTL Compatible at V_{DD} = +5 V
AD7528	8	0.18	8, µP	Ext (M)	2	2, 3, 4, 5, 6	C, I, M	C I	CMOS, +5 V to +15 V Operation, TTL Compatible at V_{DD} = +5 V
DAC-8408	8	0.19	8, µP	Ext (M)	4	2, 3, 5, 6	C, I, M	C I	CMOS, Data Readback Memory Function, Separate V_{REF}
PM-7628	8	0.20	8, µP	Ext (M)	2	2, 3, 4, 5, 6	I, M	C I	CMOS, +5 V or +15 V Operation, Improved Timing
AD7628	8	0.35	8, µP	Ext (M)	2	2, 3, 4, 5, 6	C, I, M	C I	CMOS, +12 V to +15 V Operation, TTL Compatible at V_{DD} = 12 V to 15 V
DAC-8221	12	0.45	12, µP	Ext (M)	2	2, 3, 4, 6	C, I, M	C I	CMOS, Buffered Inputs, +5 V Operation
*AD7564	12	0.2	Serial, µP	Ext (M)	4	6	I	C I	Single +5 V Supply, Separate References, 28-Pin SOIC Package
*AD7568	12	0.2	Serial, µP	Ext (M)	8	10	I	C I	Single +5 V Supply, Separate References, 44-Pin PQFP
DAC-8212	12	1.0	12	Ext (M)	2	2, 3, 5	C, I, M	C I	CMOS, +5 V or +15 V Single Supply Operation
DAC-8222	12	1.0	12, µP	Ext (M)	2	2, 3, 4, 6	C, I, M	C I	CMOS, Double Buffered Inputs, Parallel Load
DAC-8248	12	1.0	8, µP	Ext (M)	2	2, 3, 6	C, I, M	C I	CMOS, Double Buffered Inputs, Byte Load
AD7537	12	1.5 (max)	8, µP	Ext (M)	2	2, 3, 4, 5	C, I, M	C I	CMOS, Byte Load, Double Buffered
AD7547	12	1.5 (max)	12, µP	Ext (M)	2	2, 3, 4, 5, 6	C, I, M	C I	CMOS, Parallel Load
AD7549	12	1.5 (max)	4, µP	Ext (M)	2	2, 3, 4, 5	C, I, M	C I	CMOS, Nibble Load, Double Buffered
*AD1864	18		Serial, µP	Int	2	2, 5	C	C I	Dual 18-Bit Audio DAC
*AD1865	18		Serial, µP	Int	2	2	C	C I	Dual 18-Bit, 16 × F_S PCM Audio DAC

LOGDAC™

Model	Res dB	Full-Scale Range dB	Accuracy dB	Package Options	Temp Range	Page	Comments
AD7111	0.375	88.5	0.17	2, 3, 4, 6	C, I, M	C I	Low Distortion
AD7118	1.5	88.5	0.35	2, 3, 4, 5, 6	C, I, M	C I	CMOS

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Analog-to-Digital Converters

High Speed ADCs

Model	Res Bits	Through-put Rate MSPS min	Full Power BW MHz typ	Bus Interface Bits[1]	Reference Voltage Int/Ext[2]	Package Options	Temp Range	Page	Comments
AD9006	**6**	**470**	**550**	**6, µP**	**±1 V, Ext**	**4, 12**	**C, M**	**C II**	**470 MSPS, 6-Bit ADC; 8.0 pF Input Capacitance**
AD9016	**6**	**550**		**Dual 6, µP**	**±1 V, Ext**	**4, 12**	**C, M**	**C II**	**AD9006 with 1:2 Demultiplexed Data Output Demultiplexing Circuitry**
AD9000	**6**	**50**	**20**	**6**	**0.5–2 V, Ext**	**1, 3**	**C, M**	**C II**	**MIL-STD-883, Rev. C, Devices Available; Low Error Rate**
AD9028	**8**	**300**	**250**	**8**	**–2 V, Ext**	**4**	**C, M**	**C II**	**300 MSPS, 8-Bit ADC, Guaranteed Dynamic Performance**
AD9038	**8**	**300**	**250**	**Dual 8**	**–2 V, Ext**	**4**	**C, M**	**C II**	**AD9028 with On-Board 1:2 Demultiplexed Data Outputs**
AD770	**8**	**200**	**250**	**8**	**±2 V, Ext**	**1**	**C, M**	**C II**	**High Bandwidth, Error Correction**
AD9002	**8**	**125**	**160**	**8**	**0.1–(–2.1) Ext**	**1, 4**	**I, M**	**C II**	**Single Supply, Low Power, Low Input Capacitance, MIL-STD-883, Rev. C Device Available**
AD9012	**8**	**75**	**160**	**8**	**–2 V, Ext**	**3, 4**	**I, M**	**C II**	**TTL Outputs, Low Power, Low Input Cap**
***AD9058**	**8**	**50**	**175**	**8**	**+2 V, Int**	**1, 5, 14**	**C, M**	**C II**	**Dual 8-Bit, TTL Output**
AD9048	**8**	**35**	**15**	**8, µP**	**–2 V, Ext**	**2, 3, 5, 12**	**C, M**	**C II**	**35 MSPS, 8-Bit Video ADC, 16 pF Input Capacitance**
***AD9020**	**10**	**60**	**175**	**10**	**±1.75 V, Ext**	**4, 12**	**C, M**	**C II**	**Fastest 10-Bit TTL Monolithic ADC**
***AD9060**	**10**	**75**	**175**	**10**	**±1.75 V, Ext**	**4, 12**	**C, M**	**C II**	**Fastest 10-Bit ECL Monolithic ADC**
***AD9040**	**10**	**40**	**50**	**10**	**+1.2 V**	**3, 4, 5**	**C, M**	**C II**	**Low Cost, High Performance 10-Bit TTL Monolithic**
***AD773**	**10**	**18**	**75**	**10**	**+2.5, Ext**	**1, 2**	**C, M**	**C II**	**Low Power, 10-Bit 18 MSPS with On-Chip T/H**
***AD9032**	**12**	**25**	**150**	**12**	**Int**	**8**	**C, M**	**C II**	**World's Fastest Complete 12-Bit ADC**
***AD9034**	**12**	**20**	**150**	**12**	**Int**	**8**	**C, M**	**C II**	**20 Ms**
***AD9005A**	**12**	**10**	**38**	**12**	**Int**	**8**	**C, M**	**C II**	**Complete 12-Bit ADC with T/H, Reference and Timing Circuitry**
***AD1671**	**12**	**1.25**	**2**	**12**	**2.5 V, Int**	**1, 2, 4, 5**	**C, I, M**	**C II**	**Complete, Monolithic 12-Bit, 1.25 MSPS ADC**
AD9003	**12**	**1**	**10**	**12**	**Int**	**8**	**C**	**C II**	**12-Bit, 1 MSPS ADC, Single 40-Pin DIP**
***AD7886**	**12**	**.75**	**1**	**12, µP**	**+5 V, Ext**	**1, 2, 5**	**C, I, M**	**C II**	**CMOS, 12-Bit 750 kSPS Sampling ADC**
***AD9014**	**14**	**10**	**60**	**14**	**Int**	**Board**	**C**	**C II**	**Wide Spurious Free Dynamic Range**

[1]This column lists the data format for the bus with "µP" indicating microprocessor capability—i.e., for a 12-bit converter 8/12, µP indicates that the data can be formatted for an 8-bit bus or can be in parallel (12 bits) and is microprocessor compatible.

[2]Ext indicates external reference with the range of voltages listed where applicable. Ext (M) indicates external reference with multiplying capability. Int indicates reference is internal. A voltage value is given if the reference is pinned out.

Boldface Type: Product recommended for new design.

*New product.

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Analog-to-Digital Converters

Sampling Converters

Model	Res Bits	Through-put Rate kSPS max	SHA BW kHz typ[1]	Reference Volt Int/Ext[2]	Bus Interface Bits[3]	Package Options	Temp Range	Page	Comments
AD7821	8	1000	100	0–5 V, Ext	8, µP	2, 3, 4, 5, 6	I, M	C II	CMOS, Bipolar or Unipolar Operation
AD7820	8	500	14	0-5 V, Ext	8, µP	2, 3, 4, 5, 6	I, M	C II	CMOS, 8-Bit Sampling ADC
AD7569	8	400	200	Int	8, µP	2, 3, 4, 5, 6	C, I, M	C II	CMOS, Complete I/O Port with DAC, ADC, SHA, Amps and Reference
AD7669	8	400	200	Int	8, µP	2, 5, 6	C, I, M	C II	CMOS, Complete I/O Port with 2 DACs, ADC, SHA, Amps and Reference
AD7769	8	400	200	Ext	8, µP	2, 5	C	C II	CMOS, Complete 2-Channel I/O Port with Input/Output Signal Conditioning
AD7824	8	400	10	0–5 V, Ext	8, µP	2, 3, 6	C, I, M	C II	CMOS, 4-Channel, 8-Bit Sampling ADC
AD7828	8	400	10	0–5 V, Ext	8, µP	2, 3, 4, 5	C, I, M	C II	CMOS, 8-Channel, 8-Bit Sampling ADC
AD7575	8	190	50	1.23 V, Ext	8, µP	2, 3, 4, 5	C, I, M	C II	CMOS, Low Cost
*AD7776	10	500	50	2.0 V, Int/Ext	10, µP	2, 6	C, I	C II	CMOS, Single Channel Complete Sampling ADC, Single Supply, Twos Complement Output Code
*AD7777	10	500	50	2.0 V, Int/Ext	10, µP	2, 6	C, I	C II	CMOS, 4-Channel Complete ADC for Single or Simultaneous Dual Channel Sampling, Single Supply
*AD7778	10	500	50	2.0 V, Int/Ext	10, µP	10	C, I	C II	CMOS, 8-Channel Complete ADC for Single or Simultaneous Dual Channel Sampling, Single Supply
AD7579	10	50	25	2.5 V, Ext	8, µP	2, 3, 4, 5	C, I, M	C II	CMOS, Low Cost 10-Bit Sampling ADC
AD7580	10	50	25	2.5 V, Ext	10, µP	2, 3, 4, 5	C, I, M	C II	CMOS, Low Cost 10-Bit Sampling ADC
AD9003	12	1000	10000	Int	12	8	C	C II	12-Bit, 1 MSPS ADC, Single 40-Pin DIP
*AD1671	12	1250	2000	2.5 V, Int	12	1, 2, 4, 5	C, I, M	C II	Complete, Monolithic 12-Bit, 1.25 MSPS ADC
*AD7886	12	750	1000	5 V, Ext	12, µP	2, 3, 5	C, I	C II	CMOS, 12-Bit 750 kSPS Sampling ADC
AD678	12	200	1000	5 V, Int	8/12, µP	1, 2, 14	C, I, M	C II	BiMOS, High Impedance High Bandwidth Sampling Input, 10 V Range, AC/DC Tested
*AD1341	12	150	150	10 V, Int	16, µP	12	C, M	C II	High Speed 8/16 Channel DAS
*AD7893	12	140	70	2.5 V, Ext	Serial	2, 3, 6	I, M	C II	CMOS, Single Supply Sampling ADC in 8-Pin Package
*AD7892	12	140	70	2.5 V, Ext	8/12/Serial, µP	2, 3, 6	I, M	C II	±10 V Input, Single Supply Sampling ADC
AD1332	12	125	125	−5 V, Int	12, µP	1	I, M	C II	Complete 12-Bit 125 kHz Sampling ADC for Digital Signal Processing, On-Chip FIFO
*AD7874	12	29	500	Int (+3 V), Ext	12, µP	2, 3, 4, 6	C, I, M	C II	CMOS, Simultaneous Sampling 4-Channel ADC for ±10 V Input Signals
AD7870	12	100	500	3 V, Int	8/12/Serial, µP	2, 3, 4, 5	C, I, M	C II	CMOS, 100 kHz Throughput, ±3 V Input
*AD7875	12	100	500	3 V, Int	8/12/Serial, µP	2, 3, 5	C, I, M	C II	CMOS 100 kHz Throughput, 0–5 V Input
*AD7876	12	100	500	3 V, Int	8/12/Serial, µP	2, 3, 6	I, M	C II	CMOS, 100 kHz Throughput, ±10 V Input
AD7878	12	100	500	3 V, Int	12, µP	2, 3, 4, 5	C, I, M	C II	CMOS, 100 kHz Throughput, ±3 V Input, On-Chip FIFO
*AD1674	12	100	500	10 V, Int	8/12, µP	1, 2, 6	C, I, M	C II	Complete AD574A Pinout Compatible, Sampling Input, AC/DC Tested
*AD7890	12	100	50	2.5 V, Ext	Serial	2, 3, 6	I, M	C II	±10 V Input 8-Channel Single Supply Sampling ADC
*AD7891	12	100	50	2.5 V, Ext	12, µP	10	I, M	C II	±10 V Input 8-Channel Single Supply Sampling ADC

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Model	Res Bits	Through-put Rate kSPS max	SHA BW kHz typ[1]	Reference Volt Int/Ext[2]	Bus Interface Bits[3]	Package Options	Temp Range	Page	Comments
***AD7868**	**12**	**83**	**500**	**3 V, Int**	**Serial, µP**	**2, 3, 6**	**I, M**	**C II**	**CMOS, Complete I/O Port with 12-Bit ADC and 12-Bit DAC**
AD1334	**12**	**67**	**235**	**−5 V, Int**	**12, µP**	**1**	**I, M**	**C II**	**Four- Channel 67 kHz 12-Bit Sampling ADC, On-Chip FIFO**
***AD7880**	**12**	**66**	**33**	**5 V, Ext**	**12, µP**	**2, 3, 6**	**I**	**C II**	**Single +5 V Supply, Low Power Shutdown**
AD368	12	50	40–1000	6.3 V, Int	12	1	I, M	C II	Complete 12-Bit ADC, PGA with Gains of 1, 8, 64, 512
AD369	12	50	40–1000	6.3 V, Int	12	1	I, M	C II	Complete 12-Bit ADC, PGA with Gains of 1, 10, 100, 500
AD363R	12	25		10 V, Int	12, µP	1	C, M	C II	16-Channel, 12-Bit DAS
AD364R	12	20		10 V, Int	12, µP	1	C, M	C II	High Speed, 16-Channel, 12-Bit DAS with Three-State Buffered Output
AD679	**14**	**128**	**1000**	**5 V, Int**	**8, µP**	**1, 2, 14**	**C, I, M**	**C II**	**BiMOS, High Impedance, High Bandwidth Sampling Input, 10 V Input Range, AC/DC Tested**
AD779	**14**	**128**	**1000**	**5 V, Int**	**14, µP**	**1, 2, 14**	**C, I, M**	**C II**	**BiMOS, High Impedance, High Bandwidth Sampling Input, 10 V Input Range, AC/DC Tested**
***AD7869**	**14**	**83**	**500**	**3 V, Int**	**Serial**	**2, 3, 6**	**C, I**	**C II**	**CMOS, Complete I/O Port with 14-Bit DAC and 14-Bit ADC**
AD7871	**14**	**83**	**500**	**3 V, Int**	**8/14/Serial, µP**	**2, 3, 5**	**C, I, M**	**C II**	**CMOS, Complete Sampling ADC, ±3 V Input**
AD7872	**14**	**83**	**500**	**3 V, Int**	**Serial, µP**	**2, 3, 6**	**C, I, M**	**C II**	**CMOS, Complete, Serial Interface, 16-Pin DIP/SOIC**
DAS1152	14	25	X	10 V, Int	14	Module	I	C II	14-Bit High Accuracy Sampling ADC
DAS1157	14	18	X	10 V, Int	14	Module	I	C II	Low Power Sampling ADC
DAS1153	15	20	X	10 V, Int	15	Module	I	C II	15-Bit High Accuracy Sampling ADC
DAS1158	15	18	X	10 V, Int	15	Module	I	C II	Low Power, 15-Bit Sampling ADC
***AD1382**	**16**	**500**	**2200**	**10 V, Int**	**8, µP**	**1**	**C**	**C II**	**High Speed, Guaranteed Dynamic Performance**
***AD1385**	**16**	**500**	**2200**	**10 V, Int**	**8, µP**	**1**	**C, M**	**C II**	**Similar to AD1382 with Autocalibration Ability, Guaranteed Dynamic Performance**
***AD7884**	**16**	**166**	**83**	**3 V, Ext**	**16, µP**	**2, 3, 5**	**I, M**	**C II**	**CMOS, Low Power (250 mW), 5.3 µs Conversion**
***AD7885**	**16**	**166**	**83**	**3 V, Ext**	**8, µP**	**2, 3, 5**	**I, M**	**C II**	**Similar to AD7884, 28-Pin Package, Byte Output**
***AD1876**	**16**	**100**	**1000**	**3–7 V, Ext**	**Serial**	**2**	**C**	**C II**	**Autocalibrating, 16-Pin DIP ADC, AC Tested**
***AD675**	**16**	**100**	**1000**	**3–10 V, Ext**	**8/Serial, µP**	**1, 2**	**C, I, M**	**C II**	**Autocalibrating, 24-Pin DIP ADC, AC/DC Tested**
***AD676**	**16**	**100**	**1000**	**3–10 V, Ext**	**16, µP**	**1, 2**	**C, I, M**	**C II**	**Similar to AD675 but in 28-Pin DIP, Parallel Output**
AD1380	**16**	**50**	**900**	**Int**	**16/Serial**	**1**	**C**	**C II**	**Low Cost, 16-Bit Sampling ADC**
DAS1159	16	18	X	10 V, Int	16	Module	I	C II	Low Power, 16-Bit Sampling ADC

[1]X indicates that the internal SHA bandwidth is not specified in kHz.

[2]Ext indicates external reference with the range of voltages listed where applicable. Ext (M) indicates external reference with multiplying capability. Int indicates reference is internal. A voltage value is given if the reference is pinned out.

[3]This column lists the data format for the bus with "µP" indicating microprocessor capability—i.e., for a 13-bit converter 8/12, µP indicates that the data can be formatted for an 8-bit bus or can be in parallel (12 bits) and is microprocessor compatible.

Boldface Type: Product recommended for new design.

*New product.

Analog-to-Digital Converters

Nonsampling Converters

Model	Res Bits	Conv Rate µs max	Reference Voltage Int/Ext[1]	Bus Interface Bits[2]	Package Options	Temp Range	Page	Comments
ADC-908	8	6.0	−10 V, Ext	8, µP	2, 3, 4, 6	C, I, M	C II	CMOS, +5 V Operation, Fast
AD670	8	10	Int	8, µP	1, 2, 4, 5	C, I, M	C II	Single +5 V Supply, Including In-Amp and Reference
AD7576	8	10	1.23 V, Ext	8, µP	2, 3, 4, 5	C, I, M	C II	CMOS, Low Cost, Single Supply
PM-7574	8	15.0	−10 V, Ext	8, µP	2, 3, 4, 6	C, I, M	C II	CMOS, +5 V Operation
AD7574	**8**	**15**	**−10 V, Ext**	**8, µP**	**2, 3, 4**	**C, I, M**	**C II**	**CMOS, +5 V Operation**
AD570	8	25	Int	8	1	C, M	C II	
AD673	8	30	Int	8, µP	1, 2, 5	C, M	C II	
AD7581	8	66.7	−5 V to (−15 V), Ext	8, µP	2, 3, 5	C, I	C II	CMOS 8-Bit ADC
AD579	10	1.8	10 V, Int	10/Serial	1	C, M	C II	High Speed with Low Power
ADC-910	**10**	**6.0**	**2.5 V, Int**	**8, 10, µP**	**3**	**C, I, M**	**C II**	**Bipolar, Fast with Byte Output**
AD571	10	25	Int	10	1	C, M	C II	Complete 10-Bit ADC
AD573	**10**	**30**	**Int**	**8/10, µP**	**1, 2, 5**	**C, M**	**C II**	**Complete 10-Bit ADC, Byte or Parallel Interface**
AD575	10	30	Int	Serial	1, 2	C, M	C II	Complete 10-Bit ADC with Serial Interface
AD671-500	**12**	**0.5**	**5 V, Ext**	**12**	**1, 2**	**C, M**	**C II**	**12-Bit 500 ns Monolithic ADC**
AD671-750	**12**	**0.75**	**5 V, Ext**	**12**	**1, 2**	**C, M**	**C II**	**12-Bit 750 ns Monolithic ADC**
***AD7586**	**12**	**1**	**−4 V, Ext**	**12, µP**	**1, 2, 5**	**C, I**	**C II**	**CMOS 12-Bit, 1 MHz ADC**
AD578	12	3	10 V, Int	12	1	C, M	C II	Complete, 3 µs, 12-Bit ADC
***AD7572A**	**12**	**3**	**Int**	**8/12, µP**	**2, 3, 4, 6**	**C, I, M**	**C II**	**Improved Version of Industry Standard**
AD7672	12	3	−5 V, Ext	12, µP	2, 3, 4, 5	C, I, M	C II	CMOS, Unipolar or Bipolar, −12 V, +5 V Supply
AD5240	12	5	6.3 V, Int	12	1	C, M	C II	Industry Standard
AD7572	12	5	−5.25 V, Int	8/12, µP	2, 3, 4, 5	C, I, M	C II	CMOS 12-Bit ADC
***ADC-170**	**12**	**5.6**	**−5.25 V, Ext**	**Serial**	**2, 3, 6**	**I, M**	**C II**	**Complete, 3 µs, 12-Bit ADC in 8-Pin Mini-DIP**
***AD774B**	**12**	**8**	**10 V, Int**	**8/12, µP**	**1, 2, 6**	**C, I, M**	**C II**	**Faster Version of AD674B with 8 µs Conversion**
AD ADC84/85	12	10	6.3 V, Int	12	1	C, I, M	C II	Industry Standard
***ADC-912A**	**12**	**10**	**−5 V, Ext**	**12, µP**	**2, 3, 6**	**I, M**	**C II**	**CMOS, Improved Version of ADC-912**
ADC-912	12	12.5	−5 V, Ext	12, µP	2, 3, 6	C	C II	CMOS, Low Transition Noise
AD5210	12	13	−10 V, Int/Ext	12	1	I, M	C II	Industry Standard (AD5211/12/14/15)
AD674A	12	15	10 V, Int	8/12, µP	1	C, M	C II	Complete 12-Bit ADC, Industry Standard Pinout
***AD674B**	**12**	**15**	**10 V, Int**	**8/12, µP**	**1, 2, 6**	**C, I, M**	**C II**	**Improved Monolithic Version of AD674A and AD574A**
AD572	12	25	10 V, Int	12	1	I, M	C II	12-Bit Successive Approximation ADC
AD ADC80	12	30	6.3 V, Int	12	1	I	C II	Industry Standard
AD574A	**12**	**35**	**10 V, Int**	**8/12, µP**	**1, 2, 4, 5**	**C, M**	**C II**	**Complete ADC with Reference and Clock**
AD5200	12	50	−10 V, Int/Ext	12	1	I, M	C II	Industry Standard (AD5201/02/04/05)
AD7578	**12**	**100**	**5 V, Ext**	**8, µP**	**1, 2**	**C, I, M**	**C II**	**CMOS, 1 LSB Total Unadjusted Error**
AD7582	**12**	**100**	**5 V, Ext**	**8, µP**	**1, 2, 5**	**C, I, M**	**C II**	**CMOS, 4 Channel, 1 LSB Total Unadjusted Error**

Model	Res Bits	Conv Rate µs max	Reference Voltage Int/Ext[1]	Bus Interface Bits[2]	Package Options	Temp Range	Page	Comments
AD1377	16	10	Int	16, Serial	1	C	C II	Complete, High Speed 16-Bit ADC Operation over −25°C to +85°C
AD1376	16	17	Int	16, Serial	1	C	C II	Complete 16-Bit Converter; Industry Standard Pinout
***AD1378**	**16**	**17**	**Int**	**16, Serial**	**1**	**M**	**C II**	**Complete 16-Bit Converter; MIL Temp Range; Industry Standard Pinout**
ADC1140	16	35	10 V, Int	16	Module	C	C II	16-Bit ADC, Operates over −25°C to +85°C Temperature Range
AD ADC71	16	50	6.3 V, Int	16	1	C	C II	Industry Standard
AD ADC72	16	50	6.3 V, Int	16	1	C, I	C II	Industry Standard
AD1170	**18**	**1000**	**5 V, Int**	**8**	**2**	**C**	**C II**	**7 to 22-Bit Programmable Integrating ADC**

[1]Ext indicates external reference with the range of voltages listed where applicable. Ext (M) indicates external reference with multiplying capability. Int indicates reference is internal. A voltage value is given if the reference is pinned out.

[2]This column lists the data format for the bus with "µP" indicating microprocessor capability—i.e., for a 13-bit converter 8/12, µP indicates that the data can be formatted for an 8-bit bus or can be in parallel (12 bits) and is microprocessor compatible.

Boldface Type: Product recommended for new design.

*New product.

Analog-to-Digital Converters

Sigma-Delta ADCs

Model	Res Bits	Input BW kHz	Through-put Rate kHz	Reference Voltage Int/Ext[1]	Bus Interface Bits[2]	Package Options	Temp Range	Page	Comments
*AD776	16	50	100 to 400	2 V, Int	Serial	1, 2	C, I, M	C II	16-Bit 100 kSPS Oversampling ADC, Single Supply
*AD1878	16	24	2.5 to 50	3 V, Int	Serial	2	C	C II	Similar to AD1879 with 16-Bit Resolution
*AD7701	16	10 Hz	4	2.5 V, Ext	Serial, µP	2, 3, 6	I, M	C II	16-Bit Sigma-Delta ADC, 0.1–10 Hz Input Bandwidth
*AD28msp02	16	4	8	2.5, Ext	Serial, µP	6	C	C I	Complete Voice Band Linear Codec with On-Chip Filtering, Single Supply
*AD28msp01	16	3.4	7.2/8.0/9.6	2.5, Ext	Serial, µP	6	C	C I	Complete Analog Front End for High Performance, DSP-Based Modems, Single Supply
*AD1879	18	24	2.5 to 50	3 V, Int	Serial	2	C	C II	Dual Channel, High Performance Stereo 18-Bit Oversampled ADC
*AD7716	20	18.5 to 300 Hz	0.075 to 1.145	2.5 V, Int	Serial	2, 6	C	C II	Quad 20-Bit Sigma Delta ADC, Low Power with BW up to 300 Hz
*AD7703	20	10 Hz	4	2.5 V, Ext	Serial, µP	2, 3, 6	I, M	C II	20-Bit Sigma-Delta ADC, 0.1–10 Hz Input Bandwidth
*AD7710	21	DC to 262 Hz	0.01 to 1.0	2.5 V, Int	Serial, µP	2, 3, 6	I, M	C II	21-Bit Sigma-Delta Signal Conditioning ADC for Thermocouple or mV Input
*AD7711	21	DC to 262 Hz	0.01 to 1.0	2.5 V, Int	Serial, µP	2, 3, 6	I, M	C II	Similar to AD7710 but for RTD or mV Input
*AD7712	21	DC to 262 Hz	0.01 to 1.0	2.5 V, Int	Serial, µP	2, 3, 6	I, M	C II	Similar to AD7710 with Higher Input Voltage Range, More General Purpose
*AD7713	21	DC to 52.4 Hz	2.0 to 200 Hz	2.5 V, Ext	Serial, µP	2, 3, 6	I, M	C II	Loop Powered 21-Bit Sigma-Delta Signal Conditioning ADC

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Multiplexed ADCs

Model	Res Bits	# Chan	Conv Time µs	SHA BW kHz	Reference Volt Int/Ext[1]	Bus Interface Bits[2]	Package Options	Temp Range	Page	Comments
AD7769	8	2	2.5	200	Ext	8, µP	2, 5	C	C II	CMOS, Complete 2-Channel I/O Port with Input/Output Signal Conditioning
AD7824	8	4	2.5	10	0–5 V, Ext	8, µP	2, 3, 6	C, I, M	C II	CMOS, On-Chip Track-Hold
AD7828	8	8	2.5	10	0–5 V, Ext	8, µP	2, 3, 4, 5	C, I, M	C II	CMOS, On-Chip Track-Hold
AD7581	8	8	66.7		−10 V, Ext	8, µP	2, 3, 5	C, I	C II	CMOS, 8-Channel DAS
***AD1341**	12	8/16	6.67		10 V, Int	16, µP	12	C, M	C II	High Speed, 16-Channel Programmable 12-Bit DAS with 25 ns Bus Interface
AD1334	12	4	15	235	−5 V, Int	12, µP	1	I, M	C II	Four-Channel 65 kHz 12-Bit Sampling ADC for Digital Signal Processing, On-Chip FIFO
***AD7874**	12	4	32.5 (for 4 Channels)	500	3 V Int	12, µP	2, 3, 6	C, I, M	C II	CMOS, Simultaneous Sampling Four-Channel 29 kHz ADC for ±10 V Input Signals
AD363R	12	8/16	40		10 V, Int	12, µP	1	C, M	C II	High Speed, 16-Channel, 12-Bit DAS
AD364R	12	8/16	50		10 V, Int	12, µP	1	C, M	C II	16-Channel, 12-Bit DAS with Three-State Buffers
AD7582	12	4	100		4 V–6 V, Ext	12, µP	1, 2, 5	C, I, M	C II	CMOS, 1 LSB Total Unadjusted Error
***AD7890**	12	8	10	500	2.5 V, Ext	Serial, µP	2, 3, 6	I, M	C II	CMOS, 8-Channel Multiplexed ADC for ±10 V Input Signals
***AD7891**	12	8	10	500	2.5 V, Ext	12, µP	10	I, M	C II	CMOS, 8-Channel Multiplexed ADC for ±10 V Input Signals

[1]Ext indicates external reference with the range of voltages listed where applicable. Ext (M) indicates external reference with multiplying capability. Int indicates reference is internal. A voltage value is given if the reference is pinned out.

[2]This column lists the data format for the bus with "µP" indicating microprocessor capability—i.e., for a 12-bit converter 8/12, µP indicates that the data can be formatted for an 8-bit bus or can be in parallel (12 bits) and is microprocessor compatible.

Boldface Type: Product recommended for new design.

*New product.

V/F and F/V Converters

Voltage-to-Frequency Converters

Model	Full-Scale Frequency MHz	Linearity % max	FS Calib Error % typ	Output Format	Input Range V	Package Options	Temp Range	Page	Comments
AD652	**2**	**0.005–0.05**	**0.25–0.5**	**Pulse Train**	**0 to 10, ±5 0 to −10**	**3, 4, 5**	**C, I, M**	**C II**	**Synchronous, Multiple Input Ranges, Low Linearity, Single Supply**
AD650	**1**	**0.005–0.1**	**5–10**	**Pulse Train**	**0 to 10, ±5 0 to −10**	**1, 2, 5**	**C, I, M**	**C II**	**Low Nonlinearity, Multiple Input Ranges**
AD654	**0.5**	**0.1–0.4**	**10**	**Square Wave**	**0 to (V^S)**	**2, 6**	**C**	**C II**	**Single Supply, Low Cost**
ADVFC32	0.5	0.01–0.2	5	Pulse Train	0 to 10	2, 7	C, I, M	C II	Industry Standard
AD537	0.15	0.07–0.25	5	Square Wave	$-V_S$ to $(+V_S -4)$	1, 7	C, M	C II	Single Supply, Military Grade

Frequency-to-Voltage Converters

Model	Input Range kHz	Linearity % max	Response Time ms typ	Package Options	Temp Range	Page	Comments
451	0 to 10	0.03–0.008	4	Module	I	C I, C II	Complete, No External Components
453	0 to 100	0.03–0.008	0.8	Module	I	C I, C II	Complete, No External Components
AD650	**0 to 1000**	**0.005–0.1**	–	**1, 2, 5**	**C, I, M**	**C II**	**Low Nonlinearity**
ADVFC32	0 to 500	0.01–0.2	–	2, 7	C, I, M	C II	Industry Standard

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Synchro and Resolver Converters

Digital-to-Synchro and Resolver Converters

Model	Res Bits	Output Format[1]	Accuracy arc mins	Load Driving Capability	Reference Frequency Options Hz	Reference Input Volt Options V rms	Signal Output Volt Options V rms	Transformer Output Isolations	Package Options	Temp Range	Page	Comments
DRC1745	**14**	**R[2]**	**±2, ±4[3]**	**2.0VA[4]**	**dc→2600**	**0→3.4**	**0→6.8**	**Use Ext. STM 1680 and STM 1683 Transformer**	**8**	**M**	**C I**	**Digital-to-Resolver Converter with Int. 2 VA Power Amplifier. Optional Int. TransZorb† Protection. 2 Byte Latched Inputs**
***AD2S65**	**14**	**R**	**±2, ±4[3]**	**–**	**dc→2600**	**0→3.4**	**0→6.8**	**–**	**8**	**C, M**	**C I**	**Digital-to-Resolver Converter. Autonulling (AN) Option**
DRC1746	**16**	**R[2]**	**±2, ±4[3]**	**2.0VA[4]**	**dc→2600**	**0→3.4**	**0→6.8**	**Use Ext. STM 1680 and STM 1683 Transformer**	**8**	**M**	**C I**	**16-Bit Version of DRC1745**
***AD2S66**	**16**	**R**	**±1, ±2, ±4[3]**	**–**	**dc→2600**	**0→3.4**	**0→6.8**	**–**	**8**	**C, M**	**C I**	**Digital-to-Resolver Converter. Autonulling (AN) Option**

Motor Control

Model	Description	Package Options	Temp Range	Page	Comments
***AD2S100**	**AC Vector Controller**	**15**	**I**	**C I**	**Vector Coordinate Transformation, 15 arc min, 2 μs Settling Time**

Synchro/Resolver Support Components

Model	Description	Package Options	Temp Range	Page	Comments
***AD2S75**	**Signal and Reference Isolation for AD2S80/81/82**	8	C, M	C I	**56–20,000 Hz Freq, 11.8–115 V rms Ref, 11.8/26/90 V rms Input**
***AD2S99**	**Monolithic Sine Wave Oscillator Reference**	5	I	C I	2.0–20 kHz Frequency range, Phase Shift Compensation
***OSC1758**	**Hybrid Sine/Cosine Power Oscillator**	8	C, M	C I	**0.0–10 kHz Frequency Range, In-phase and Quadrature Outputs, 1.5 W Output Power**
*IPA1764	Inductosyn Preamplifier	8	C, M	C I	Gain of 1250 ±5%

[1]S = Synchro; R = Resolver; I = Inductosyn.
[2]Synchro format output with external output transformer STM1683.
[3]Depends on option.
[4]Can be used with pulsating power supply for reduced dissipation.
Boldface type: product recommended for new design.
*New product.
†TransZorb is a trademark of General Semiconductor Industries, Inc.

Synchro and Resolver Converters

Synchro, Resolver, Inductosyn† and LVDT-to-Digital Converters

Model	Res Bits	Input Format[1]	Accuracy arc mins	Tracking Rate Options revs/sec[2]	Reference Frequency Options Hz	Input Isol	Package Options	Temp Range	Page	Comments
SDC/RDC1741	12	S, R	±15.3	18	400, 2.6 k	Yes	8	C, M	C I	Tristate, Latched Output Internal Transformer Isolation
SDC/RDC1742	12	S, R	±8.5	18	400, 2.6 k	Yes	8	C, M	C I	Tristate, Latched Output Internal Transformer Isolation
*AD2S81A[3]	12	I, R	±30[4]	260	400→20 k	No	1	C	C I	Monolithic, User Selectable Dynamic Characteristics, High Tracking Rate, Quality Velocity Output, Class 2 ESD
SDC/RDC1740	14	S, R	±5.3	12	400, 2.6 k	Yes	8	C, M	C I	Tristate, Latched Output Internal Transformer Isolation
2S54	14	LVDT	±0.006[5]	360 LSB/ms[6]	360→5 k	No	8	C, M	C I	Direct Ratiometric Conversion of LVDT Signal, Selectable Input Gain. No External Trims
2S56	16	LVDT	±0.006[4]	360 LSB/ms[6]	360→5 k	No	8	C, M	C I	Direct Ratiometric Conversion of LVDT Signal, Selectable Input Gain. No External Trims
2S58	16	LVDT	±0.003[5]	680 LSB/ms[6]	7 k→11 k	No	8	C, M	C I	Direct Ratiometric Conversion of LVDT Signal, High Gain, Ultra-Linear
*AD2S80A[3]	16, 14, 12, 10[7]	I, R	±2, ±4, ±8	1040[8]	50–20 k	No	1, 4	C, I, M	C I	Monolithic, User Selectable Dynamic Characteristics, and Resolution High Tracking Rate and Quality Velocity Output, Class 2 ESD
*AD2S82A[3]	16, 14, 12, 10[5]	I, R	±2, ±4, ±8	1040[8]	50–20 k	No	5	C	C I	Monolithic, User Selectable Dynamic Characteristics, and Resolution High Tracking Rate and Quality Velocity Output, Class 2 ESD
*AD2S83	16, 14, 12, 10	R	±8	1040	50–20 k	No	5	I	C I	Monolithic, User Selectable Dynamic Characteristics, and Resolution High Tracking Rate and ±0.25% Linearity Velocity Output
*AD2S34	14	R	±2.6, ±4.0	20, 48	0.4, 2.6, 4.0 k	No	12	M	C I	Dual Channel Resolver-to-Digital Converter with On-Board Oscillator. No External Trims
*AD2S46	16	S, R	±1.3, ±2.6	12	0.4→2.6 k	No	1	M	C I	16 Bit Resolver/Synchro-to-Digital Converter, 1.3 arc min in a 28-Pin DIP Ceramic Package. No External Trims

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Model	Res Bits	Input Format[1]	Accuracy arc mins	Tracking Rate Options revs/sec[2]	Reference Frequency Options Hz	Input Isol	Package Options	Temp Range	Page	Comments
***AD2S44**	**12**	**S, R**	**±2.6,[9] ±4.0, ±5.2**	**20**	**0.4→2.6 k**	**No**	**8**	**M**	**C I**	**Dual Channel Resolver/ Synchro-to-Digital Converter with Loss of Track Detection. No External Trims**
***AD2S90**	**12, 10**	**R**	**±8**	**375, 1500**	**2.0→10.0 k**	**No**	**5**	**C, I**	**C I**	**Low Cost RDC, Encoder-Like Output**
***AD2S47**	**16, 14**	**S, R**	**±1.3, ±2.6**	**5, 20**	**200, 400**	**No**	**8**	**M**	**C I**	Second Source for NATEL HSRDC 1006/56, 75 mW Power Consumption, MIL-STD-883
***AD2S93**	**14**	**LVDT**	**0.1, 0.05%**	**TBD**	**2.0–10.0 k**	**No**	**5**	**I**	**C I**	14-Bit LVDT-to-Digital Converter

[1]S = Synchro; R = Resolver; I = Inductosyn.
[2]Revs/sec equivalent to pitches/sec in the case of an Inductosyn; in general, higher reference frequency options have higher tracking rates.
[3]Die Revision.
[4]Consult data sheet.
[5]LVDT converter accuracy given as % full-scale linearity.
[6]Slew Rate (min).
[7]Resolution is user selectable.
[8]Depends on resolution selected.
[9]±2.6 arc min only available over 0°C to 70°C.
Boldface type: product recommended for new design.
*New product.
†Inductosyn is a registered trademark of Farrand Industries, Inc.

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Analog Switches & Multiplexers

CMOS Switches

Model	Function	Leakage Current nA max	R_{ON} Ohms max	Latched	Package Options	Temp Range	Page	Comments
*ADG411	Quad SPST	0.25	35		2, 3, 6	I, M	C II	Second Source to DG411, Dielectrically Isolated
*ADG412	Quad SPST	0.25	35		2, 3, 6	I, M	C II	Second Source to DG412, Dielectrically Isolated
*ADG441	Quad SPST	0.25	80		2, 3, 6	I, M	C II	Second Source to DG441, Upgrade for DG201A/ADG201A, Dielectrically Isolated
*ADG442	Quad SPST	0.25	80		2, 3, 6	I, M	C II	Second Source to DG442, Upgrade for DG202A/ADG201A, Dielectrically Isolated
*ADG444	Quad SPST	0.5	80		2, 3, 6	I, M	C II	Superior Second Source to DG444, Dielectrically Isolated
*ADG445	Quad SPST	0.5	80		2, 3, 6	I, M	C II	Superior Second Source to DG445, Dielectrically Isolated
ADG201HS	Quad SPST	1	50		2, 3, 4, 5, 6	C, I, M	C II	High Speed Quad Switch, 44 V Supply Maximum Ratings
ADG201A	Quad SPST	1–2	90		2, 3, 4, 5, 6	C, I, M	C II	44 V Supply Maximum Ratings
ADG202A	Quad SPST	1–2	90		2, 3, 4, 5, 6	C, I, M	C II	44 V Supply Maximum Ratings
ADG221	Quad SPST	1–2	90	X	2, 3, 4, 5, 6	C, I, M	C II	Latched Input, 44 V Supply Maximum Ratings
ADG222	Quad SPST	1–2	90	X	2, 3, 4, 5	C, I, M	C II	Latched Input, 44 V Supply Maximum Ratings
AD7510DI	Quad SPST	5–10	100		2, 3, 4, 5	C, M	C II	DiCMOS, Dielectrically Isolated
AD7511DI	Quad SPST	5–10	100		2, 3, 4, 5	C, M	C II	DiCMOS, Dielectrically Isolated
AD7590DI	Quad SPST	5	90	X	2, 3, 4, 5	C, I, M	C II	DiCMOS, Latched Input, Dielectrically Isolated
AD7591DI	Quad SPST	5	90	X	2, 3, 4, 5	C, I, M	C II	DiCMOS, Latched Input, Dielectrically Isolated
*SSM-2404	Quad SPST	10	85		2, 6	I	C II	"Clickless" Quad Audio Switch (CBCMOS)
ADG211A	Quad SPST	5	115		2, 5, 6	C	C II	Low Cost, 44 V Supply Maximum Ratings
ADG212A	Quad SPST	5	115		2, 5, 6	C	C II	Low Cost, 44 V Supply Maximum Ratings
AD7512DI	Dual SPDT	5–10	100		2, 3, 4, 5	C, M	C II	DiCMOS, Dielectrically Isolated
AD7592DI	Dual SPDT	5	90	X	2, 3, 4, 5	C, M	C II	DiCMOS, Latched Input, Dielectrically Isolated

Bipolar JFET Switches

Model	Function	Leakage Current nA max	R_{ON} Ohms max	Package Options	Temp Range	Page	Comments
SW-01	Quad SPST	1.0	100	3	I	C II	Improved DG201
SW-02	Quad SPST	1.0	100	3	I	C II	Improved DG202
SW-06	Quad SPST	2.0	80	2, 3, 4, 6	I, M	C II	Improved LF11333/13333
SW-201	Quad SPST	10.0	150	2, 6	I	C II	Improved Low Cost DG201
SW-202	Quad SPST	10.0	150	2, 6	I	C II	Improved Low Cost DG202
SW-7510	Quad SPST	1.0	75	3, 4	I, M	C II	Improved HI-7510
SW-7511	Quad SPST	1.0	75	3, 4	I, M	C II	Improved HI-7511
SSM-2402	Dual SPST	10.0	85	2, 6	I	C II	"Clickless" Bilateral Audio Switch
SSM-2412	Dual SPST	10.0	85	2, 6	I	C II	Fast, Dual Audio Switch

CMOS Multiplexers

Model	Function	Leakage Current nA max	R_{ON} Ohms max	Latched	Package Options	Temp Range	Page	Comments
***AD75019**	**16:16**	**10**	**300**		**5**	**C, I**	**C II**	**16 × 16 Analog Crosspoint, Serial Interface**
ADG506A	**16:1**	**1**	**280**		**2, 3, 4, 5, 6**	**C, I, M**	**C II**	**Superior Second Source to DG506A**
ADG526A	**16:1**	**1**	**280**	**X**	**2, 3, 4, 5, 6**	**C, I, M**	**C II**	**Superior Second Source to DG526A**
*AD7506	16:1	1-5	300		2, 3, 4	C, M	C II	
ADG507A	**Diff. 8:1**	**1**	**280**		**2, 3, 4, 5, 6**	**C, I, M**	**C II**	**Superior Second Source to DG507A**
ADG527A	**Diff. 8:1**	**1**	**280**	**X**	**2, 3, 4, 5, 6**	**C, I, M**	**C II**	**Superior Second Source to DG527A**
*AD7507	Diff. 8:1	1-5	300		2, 3, 4	C, M	C II	
***ADG408**	**8:1**	**0.5**	**100**		**2, 3, 6**	**C, I, M**	**C II**	**Superior Second Source to DG408**
ADG508A	**8:1**	**1**	**300**		**2, 3, 4, 5, 6**	**C, I, M**	**C II**	**Superior Second Source to DG508A**
ADG528A	**8:1**	**1**	**300**	**X**	**2, 3, 4, 5**	**C, I, M**	**C II**	**Superior Second Source to DG528A**
AD7501	8:1	1–5	300		2, 3, 4	C, M	C II	
AD7503	8:1	1–5	300		2, 3, 4	C, M	C II	
***ADG409**	**Diff. 4:1**	**0.5**	**100**		**2, 3, 6**	**C, I, M**	**C II**	**Superior Second Source to DG409**
ADG509A	**Diff. 4:1**	**1**	**300**		**2, 3, 4, 5, 6**	**C, I, M**	**C II**	**Superior Second Source to DG509A**
ADG529A	**Diff. 4:1**	**1**	**300**	**X**	**2, 3, 4, 5**	**C, I, M**	**C II**	**Superior Second Source to DG529A**
AD7502	Diff. 4:1	1–5	300		2, 3, 4	C, M	C II	

Bipolar JFET Multiplexers

Model	Function	Leakage Current nA max	R_{ON} Ohms max	Package Options	Temp Range	Page	Comments
MUX-08	**8:1**	**1.0**	**300**	**2, 3, 4, 6**	**C, I, M**	**C II**	**Improved DG508**
MUX-16	**16:1**	**1.0**	**380**	**2, 3, 4, 5**	**I, M**	**C II**	**Improved DG506**
MUX-24	**Diff. 4:1**	**1.0**	**300**	**2, 3, 4, 6**	**C, I, M**	**C II**	**Improved DG509**
MUX-28	**Diff. 8:1**	**1.0**	**380**	**2, 3, 4, 5**	**I, M**	**C II**	**Improved DG507**
MUX-88	8:1	100	400	3	I	C II	8-Channel Telecom Multiplexer

Video Multiplexer

Model	Function	Full Power BW MHz min	Crosstalk Rejection f = 10 MHz dB	Package Options	Temp Range	Page	Comments
AD9300	**4:1**	**30**	**75**	**3, 4**	**C, M**	**C II**	**Wideband Video Mux**

Boldface Type: Product recommended for new design.
*New product.

Sample/Track-Hold Amplifiers

Model	Specified Accuracy %	Acquisition Time µs max	Aperture Time ns typ	Aperture Jitter ns typ	Droop Rate µV/µs max	Package Options	Temp Range	Page	Comments
AD1154	**0.00076**	**5.0**	**80**	**0.15**	**0.1**	**13**	**C, I**	**C II**	**Low Cost 16-Bit Accurate, High Speed Amplifier**
AD386	**0.00076**	**4.1**	**12**	**0.04**	**0.1**	**1**	**C, M**	**C II**	**High Resolution, High Speed Track-and-Hold Amplifier**
AD389	**0.003**	**2.5**	**30**	**0.4**	**0.1**	**1**	**C, I**	**C II**	**High Resolution Track-and-Hold Amplifier**
***AD9100**	**0.01**	**0.023**	**0.8**	**<0.001**	**6000**	**1, 14**	**C, I, M**	**C II**	**Ultrahigh Speed Monolithic T/H, Low Distortion**
***AD783**	**0.01**	**0.25**	**15**	**0.01**	**1**	**2, 3**	**C, I, M**	**C II**	**Complete 250 ns Sample-and-Hold Amplifier**
***AD781**	**0.01**	**0.7**	**25**	**0.05**	**1**	**2, 3**	**C, I, M**	**C II**	**Complete 700 ns Sample-and-Hold Amplifier**
***AD682**	**0.01**	**0.7**	**25**	**0.05**	**1**	**2, 3**	**C, I, M**	**C II**	**Two-Channel 700 ns Sample-and-Hold Amplifier**
AD684	**0.01**	**1.0**	**20**	**0.1**	**1**	**3**	**C, I, M**	**C II**	**Quad, Monolithic 1 µs SHA**
AD346	0.01	2.0	60	0.4	0.5	1	C, M	C II	High Speed Sample-and-Hold, Industry Standard
AD585	**0.01**	**3.0**	**35**	**0.5**	**1**	**3, 4, 5**	**C, I, M**	**C II**	**High Speed, Precision, On-Board Hold Cap**
SMP-10	**0.01**	**3.5**	**50**	**1**	**0.02**	**3**	**C, M**	**C II**	**Low Droop Rate, High Sample/Hold Current Ratio**
SMP-11	**0.01**	**3.5**	**50**	**1**	**0.2**	**2, 3**	**C, I, M**	**C II**	**Low Droop Rate, Fast Hold Mode Settling Time**
***SMP-18**	**0.01**	**3.5**	**—**	**—**	**0.04**	**2, 3, 6**	**I**	**C II**	**Fast SMP-08**
AD583	0.01	5.0	50	5		1	C	C II	5 µs SHA
SMP-04	**0.01**	**7.0**	**—**	**—**	**0.025**	**2, 3, 6**	**I, M**	**C II**	**CMOS, Quad Sample-and-Hold Amplifier**
SMP-81	0.045	3.5	50	1	2.0	3	I	C II	High Accuracy, Fast Acquisition for PCM Encodes
AD582	0.1	6.0	200	15		1, 8	C, M	C II	Low Cost, 15 µs
SMP-08	**0.1**	**7.0**	**—**	**—**	**0.02**	**2, 3, 6**	**I, M**	**C II**	**Octal, Sample-and-Hold with Multiplexed Input**

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Voltage References

Model	Output Voltage V	Initial Accuracy % FS max	Temp Stability pm/°C max	Package Options	Temp Range	Page	Comments
AD589	**+1.235**	**1.2–2.8**	**10–100**	**7**	**C, M**	**C II**	**Two Terminal, 1.2 V Reference**
***AD680**	**+2.5**	**0.2–0.4**	**20–30**	**2, 6, 16**	**C, I**	**C II**	**Low Cost, Low Power 2.5 V Reference**
AD580	**+2.5**	**0.4–3**	**10–85**	**7**	**C, M**	**C II**	**Precision, Three Terminal, 2.5 V Reference**
AD1403/AD1403A	+2.5	0.4–1	25–40	2	I	C II	Second Source, 2.5 V Reference
REF-43	**+2.5**	**0.6–1**	**10–25**	**2, 3, 6, 7**	**I, M**	**C II**	**Precision Bandgap Reference**
REF-03	**+2.5**	**0.6**	**50**	**2, 6**	**I**	**C II**	**Low Cost Bandgap Reference**
AD586	**+5**	**0.05–0.4**	**5–25**	**3, 6**	**C, M**	**C II**	**Precision, Buried Zener 5 V Reference**
REF-02	**+5**	**0.3–0.5**	**8.5–25**	**2, 3, 4, 6, 7**	**C, I, M**	**C II**	**Precision Bandgap Reference**
REF-05	**+5**	**0.3–0.6**	**8.5–25**	**7**	**M**	**C II**	**Guaranteed Long Term Stability**
AD2710	+10	0.01	1–5	2	C	C II	Ultrahigh Precision 10 V Reference
AD2700	+10	0.025–0.05	3–10	1	C, M	C II	Very High Precision 10 V Reference
AD587	**+10**	**0.05–0.1**	**5–20**	**3, 6**	**C, M**	**C II**	**Precision 10 V Buried Zener Reference**
AD581	**+10**	**0.05–0.3**	**5–30**	**7**	**C, M**	**C II**	**Three Terminal 10 V Bandgap Reference**
REF-01	**+10**	**0.3–0.5**	**8.5–25**	**2, 3, 4, 6, 7**	**C, I, M**	**C II**	**Precision Bandgap Reference**
REF-10	**+10**	**0.05–0.4**	**5–25**	**2, 3, 6, 7**	**I, M**	**C II**	**Precision Bandgap Reference**
AD2712	**±10**	**0.01**	**1–5**	**2**	**C**	**C II**	**Ultrahigh Precision ±10 V Reference**
AD688	**±10**	**0.02–0.05**	**1.5–6**	**3**	**I, M**	**C II**	**High Precision Monolithic ±10 V Reference**
AD2702	**±10**	**0.025–0.05**	**3–10**	**1**	**C, M**	**C II**	**Very High Precision ±10 V Reference**
AD2701	**−10**	**0.025–0.05**	**3–10**	**1**	**C, M**	**C II**	**Very High Precision −10 V Reference**
REF-08	**−10, −10.24**	**0.3–0.4**	**50–100**	**2, 3, 6**	**I, M**	**C II**	**General Purpose Buried Zener Reference, Pin Selectable Output**
AD588	**Selectable**	**0.01**	**1.5–6**	**2, 3, 4**	**C, I, M**	**C II**	**Ultrahigh Precision, Monolithic Programmable Reference**
AD584	**Selectable**	**0.05–0.3**	**5–30**	**4, 7**	**C, M**	**C II**	**Precision, Programmable Bandgap Reference**

Boldface Type: Product recommended for new design.
*New product.

Comparators

Model	Prop Delay ns max	Dispersion ps	Logic	V_{OS} mV max	Package Options	Temp Range	Page	Comments
AD96685	3.5	50	ECL	2	3, 4, 5, 6, 7	I, M	L	Ultrafast
AD96687	3.5	50	ECL	2	3, 4, 5, 6	I, M	L	Dual AD96685
AD9696	7.0	100	TTL	2	2, 3, 6, 7, 12	C, M	L	Single Comparator
AD9698	7.0	100	TTL	2	3, 6, 7, 12	C, M	L	Dual Comparator
CMP-08	9.5	—	ECL	2.5	3	I, M	P	High Speed with ECL Outputs
AD790	45	—	TTL	0.25–1	2, 3, 6	C, I, M	L	Fast, Precise Single Supply
CMP-05	55	—	TTL	0.6	2, 3, 6, 7	I, M	P	High Speed Precision Comparator
CMP-01	180	—	TTL	0.8	2, 3, 7	C, M	P	Fast Precision Comparator
CMP-02	270	—	TTL	0.8	2, 3, 7	C, M	P	Low Input Current Precision Comparator
CMP-04	300 typ	—	TTL	1.0	2, 3, 6	I, M	P	Quad Low Power Precision Comparator
CMP-404	800	—	TTL	1.0	3	I, M	P	Quad Low Power Precision Comparator

Matched Transistors

Model	Type	V_{OS} Max µV	TCV_{OS} Max µV/°C	hFE Min[1]	ΔhFE max %	en max nV/√Hz[2]	Package Options	Temp Range	Page	Comments
MAT-01	Dual NPN	100	0.5	500	3	7.5	7	M	P	Low Cost
MAT-02	Dual NPN	50	0.1	500	2	1	4, 7	I, M	P	Low Noise
MAT-03	Dual PNP	100	0.5	100	2	1	4, 7	I, M	P	Low Noise
MAT-04	Quad NPN	200	1	300	2	2.5	2, 3, 6	I, M	P	Low Cost
SSM-2210	Dual NPN	200	1	300	5	1	2, 6	I	P	Low Cost, Audio
SSM-2220	Dual PNP	200	1	80	6	1	2, 6	I	P	Low Cost, Audio

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Low Noise Amplifiers

Model	Voltage Noise en typ 1 kHz $nV\sqrt{Hz}$	Voltage Noise en typ 10 kHz $nV\sqrt{Hz}$	Current Noise In ± In− typ 1 kHz $pA\sqrt{Hz}$	I_B typ nA	V_{OS} mV typ	GBW MHz typ	SR V/μs typ	Settling Time ns to % typ	A_{CL} min V/V	Package Options	Temp Range	Page	Comments
AD9610	1.6	0.7	32/32	5000	0.3	100	3500	1–0.1	1	2	I, M	L	Wide Bandwidth, Fast Settling
AD9617	2.0	1.3	32/32	12000	0.5	570	1400	10–0.1	±1	2, 3, 6, 12	C, I, M	L	Low Distortion, Wide Bandwidth
AD9618	2.0	1.3	32/32	10000	0.5	8000	1800	9–0.1	+5, −1	2, 3, 6, 12	C, I, M	L	Low Distortion, Wide Bandwidth
AD829	2	—	1.5	3300	0.2	750	230	65–0.1	1	2, 3, 6	C, I, M	L	High Speed, Low Noise, Video Amp
AD844	2	—	12/10	200	0.05	900	2000	100–0.1	1	2, 3, 6	I, M	L	Current Feedback Amplifier
AD846	2	—	6/20	100	0.025	450	450	110–0.01	1	2, 3	I, M	L	Current Feedback, Precision
AD849	3	—	—	3300	0.3	725	300	80–0.1	25	2, 3, 6	C, I, M	L	High Speed, Low Power
OP-27	3.0	3.5	0.4	10	0.01	8	2.8	—	1	2, 3, 4, 6, 7	C, I, M	P	Low Noise, Precision
AD OP-27	3	3.5	0.4	10	0.025	8	1.7	—	1	2, 3, 7	I, M	L	Low Noise, Precision
OP-227	3	3.5	0.4	10	0.02	8	2.8	—	1	3	C, I, M	P	Dual Matched Precision
OP-37	3	3.5	0.4	10	0.01	63	17	—	1	2, 3, 4, 6, 7	C, I, M	P	Fast, Precision $A_{VCL} \geq 5$
AD OP-37	3	3.5	0.4	10	0.025	63	17	—	5	2, 3, 7	I, M	L	Low Noise, Precision
***AD745**	3.2	2.9	0.007	0.150	0.1	20	12.5	5000–0.01	5	2, 3, 6	C, I, M	D	Ultralow Noise, High Speed, BiFET Op Amp
AD743	3.2	2.9	0.007	0.15	0.1	4.5	2.8	—	1	2, 3, 6	C, I, M	L	Ultralow Noise FET Input
OP-270	3.2	3.6	0.6	5	0.01	5	2.4	—	1	2, 3, 4, 6	I, M	P	Dual Monolithic
SSM-2139	3.2	3.2	0.6	5	0.02	30	11	—	3	2	I	P	Dual Audio
SSM-2134	3.5	3.5	0.6	350	0.3	10	13	—	3	2	I	P	Improved Replacement for "5534A"
OP-470	3.2	3.8	0.4	6	0.1	6	2	—	1	2, 3, 4, 6	I, M	P	Quad Monolithic, Low Noise
AD5539	4	—	—	6000	2	1400	600	12–1	+5,−4	2, 3	C, M	L	Improved Replacement for NE5539
AD840	4	—	—	3500	0.1	400	400	100–0.01	10	2, 3, 4	C, M	L	Wide Bandwidth, Precision
OP-50	4.5	5.5	0.23	1	0.01	25	3	—	5	3	I, M	P	High Output Current
AD848	5	—	—	3300	0.2	175	300	100–0.1	5	2, 3, 6	C, I, M	L	High Speed, Low Power
OP-471	6.5	9	0.4	7	0.25	6.5	8	—	1	2, 3, 4, 6	I, M	P	Quad Monolithic, Fast
OP-271	7.6	16	0.6	4	0.075	5	8.5	—	1	2, 3, 4, 6	I, M	P	Dual Monolithic, Fast
OP-61	3.4	16	1.7	130	0.1–0.2	200	45	300–0.01	10	2, 3, 4, 6	I, M	P	Wide Bandwidth
AD645	9	8	0.6/0.6	0.0007	0.1	2	2	—	1	2, 7	C, I, M	L	FET Input, Low I_B

[1] I_C = 1 mA
[2] $f_C \geq 100$ Hz
Boldface Type: Product recommended for new design.
*New product.

Operational Amplifiers

High Speed Amplifiers

Model	SR V/μs typ	GBW MHz typ	Settling Time ns to % typ	A_{CL} min V/V	V_{OS} mV typ	I_{OUT} mA min	Supply Current mA typ	Package Options	Temp Range	Page	Comments
AD9610	3500	100	18–0.1	1	0.3	50	21	7	I, M	L	Wide Bandwidth, Fast Settling
AD844	2000	900	100–0.1	1	0.05	80	6.5	2, 3, 6	I, M	L	Constant 10 ns Rise Time for Any Pulse Input, Current Feedback
AD9618	1800	8000	10–0.1	−1	0.2	60	31	2, 3, 6, 12	C, I, M	L	Low Distortion, Wideband, IMD ≤ −70 dBc at 20 MHz
AD9617	1600	570	10–0.1	1	0.4	60	34	2, 3, 6, 12	C, I, M	L	Low Distortion, Wide Bandwidth, IMD≤ −70 dBc at 20 MHz
OP-160	1300	90	75–0.1	1	2	35	6.5	2, 3, 6	I, M	P	High Speed, Current Feedback
OP-260	1000	90	250–0.1	1	1	20	9	2, 3, 4, 6, 7	I, M	P	Dual Current Feedback
AD5539	600	1400	12–1	+5, −4	2	11	25	2, 3	C, M	L	Improved Replacement for SE/NE5539
AD846	450	450	110–0.01	1	0.025	65 typ	5	2, 3	I, M	L	High Speed, Precision, Current Feedback
AD840	400	400	100–0.01	10	0.1	50	10.5	2, 3, 4	C, M	L	Wide Bandwidth Precision, Fast Settling, A_{VCL}≥10
AD842	375	80	100–0.01	2	0.5	50	13	2, 3, 4, 7	C, M	L	Fast Settling, High Current Output, Cable Driver, A_{VCL} ≥ 2
AD849	300	725	80–0.1	25	0.3	32 typ	5.1	2, 3, 6	C, I, M	L	High Speed, Low Power Preamp, Drives Capacitive Loads
AD848	300	175	100–0.1	5	0.2	32 typ	5.1	2, 3, 6	C, I, M	L	High Speed, Low Power, Drives Capacitive Loads
AD827	300	50	120–0.1	1	0.5	32 typ	10	2, 3, 6	C, I, M	L	Dual AD847
AD847	300	50	120–0.1	1	0.5	32 typ	5.1	2, 3, 6	C, I, M	L	High Speed, Low Power, Drives Capacitive Loads
AD841	300	40	110–0.01	1	0.5	50	11	2, 3, 4, 7	C, M	L	High Speed, Precision, Drives Capacitive Loads
AD843	250	34	135–0.01	1	0.5	50	12	2, 3, 4, 6, 7	C, I, M	L	FET Input, Fast Settling, High Speed
AD829	230	750	65–0.1	1	0.2	32 typ	5	2, 3, 6	C, I, M	L	High Speed, Low Noise, Video Amp
OP-64	170	80	100–0.1	5	0.4–1.2	50	6.2	2, 3, 4, 6, 7	I, M	P	Wide Bandwidth, High Output Current
OP-44	120	23	200–0.1	3	0.3–1.5	20	6.5	3, 7	I, M	P	High Speed, Precision
AD845	100	16	350–0.01	1	0.7	50 typ	10	2, 3, 6	C, I, M	L	FET Input, Fast Settling, High Speed
AD744	75	13	500–0.01	+2, −1	0.3	25	3.5	2, 3, 6, 7	C, I, M	L	FET Input, Fast Settling, High Speed, Custom Compensation
AD746	75	13	500–0.01	+2, −1	0.3	25	3.5	2, 3, 6, 7	C, I, M	L	Dual AD744
OP-17	60	30	600–0.1	1	0.2–0.5	5.5	4.6	2, 3, 6, 7	C, I, M	P	Precision, Low Power
OP-42	58	10	800–0.01	1	0.3–1.5	20	5.1	2, 3, 4, 6, 7	I, M	P	Precision, Fast Settling
SSM-2131	50	10	900–0.01	1	1.5	20	5.7	2, 6	I, M	P	Ultralow Distortion, Low Cost
*AD811	2500	140	25–0.1	1	0.5	100 typ	16.5	2, 3, 4, 6	I, M	L	High Speed Video Amp 0.0120/0.01° Differential Gain/Phase Error

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Model	SR V/μs typ	GBW MHz typ	Settling Time ns to % typ	A_{CL} min V/V	V_{OS} mV typ	I_{OUT} mA min	Supply Current mA typ	Package Options	Temp Range	Page	Comments
OP-61	45	200	300–0.01	10	0.1–0.2	22	6.1	2, 3, 4, 6	I, M	P	Wide Bandwidth, Ultralow Noise
PM-157A	45	20	4000–0.01	1	1	5	5	3, 7	C, M	P	Improved Industry Standard
OP-16	25	8	900–0.1	1	0.2–0.5	5.5	4.6	2, 3, 6, 7	C, I, M	P	Precision, Low Power
OP-249	22	4.7	900–0.01	1	0.2–0.4	20	5.6	2, 3, 4, 6, 7	I, M	P	Dual Precision, Low Power, Low Distortion
AD711	20	4	1000–0.01	1	0.3	25 typ	2.5	2, 3, 6, 7	C, I, M	L	Precision BiFET
AD712	20	4	1000–0.01	1	0.3	25 typ	5	2, 3, 6, 7	C, I, M	L	Dual AD711
AD713	20	4	1000–0.01	1	0.3	25 typ	10	2, 3, 7	C, I, M	L	Quad AD711
OP-215	18	5.7	900–0.1	1	0.2–2	5.5	6	2, 3, 4, 6, 7	C, I, M	P	Dual Precision
OP-01	18	2.5	700–0.1	1	0.3–2	6	1.6	2, 3, 7	C, M	P	Inverting, High Speed
OP-15	13	6	1200–0.1	1	0.2–0.5	5.5	2.7	2, 3, 6, 7	C, I, M	P	Precision, Low Power
*AD745	12.5	2.0	5000–0.01	5	0.1–0.25	20	8	2, 3, 6	C, I, M	D	Ultralow Noise, High Speed, BiFET Op Amp
PM-156A	12	4.5	4000–0.01	1	1	5	5	3, 4, 7	C, M	P	Improved Industry Standard
SSM-2139	11	30	—	3	0.02	20	4	2	I	P	Dual, Low Noise
*OP-282	9.0	4	1500–0.01	1	1	10	0.5	2, 3, 6	I	D	Dual High Speed, Low Power
*OP-482	9.0	4	1500–0.01	1	2	10	1.0	2, 3, 6	I	D	Quad High Speed, Low Power

Single Supply Amplifiers

Model	ISY max mA	V_{OS} max mV	Supply Voltage Range V	GBW typ MHz	SR typ V/μs	Package Options	Temp Range	Page	Comments
OP-22	0.0002–0.4	0.3–1	+3 to +30	0.25	0.08	2, 3, 6, 7	I, M	P	Programmable
OP-32	0.0005–2	0.3–1	+3 to +30	4.5	1.5	2, 3	I, M	P	Fast, Programmable A_{VCL} = 10
OP-90	0.02	0.15–0.45	+1.6 to +36	0.02	—	2, 3, 4, 6	I, M	P	Micropower, Low Voltage
OP-290	0.04	0.2–0.5	+1.6 to +36	0.02	—	2, 3, 4, 6	I, M	P	Dual Micropower, Low Voltage
OP-20	0.08	0.25–1	+5 to +30	0.1	0.05	2, 3, 4, 6	I, M	P	Micropower, Low Cost
OP-490	0.08	0.5–1	+1.6 to +36	0.02	—	2, 3, 4, 6	I, M	P	Quad Micropower, Low Voltage
OP-220	0.17	0.15–0.75	+5 to +30	0.2	0.05	2, 3, 6, 7	I, M	P	Dual Micropower, Low Cost
OP-80	0.325	1.5	+5 to +16	0.3	0.4	2, 6, 7	I, M	P	Low I_B, CMOS
OP-420	0.36	2.5–6	+5 to +30	0.15	0.05	2, 3, 4, 6	I, M	P	Quad Micropower, Low Cost
OP-21	0.3–0.4	0.1–0.5	+5 to +30	0.6	0.25	2, 3, 6, 7	I, M	P	Low Cost, Low Power
OP-221	0.8	0.15–0.5	+5 to +30	0.6	0.3	2, 3, 6, 7	I, M	P	Dual Low Cost, Low Power
OP-421	1.8	2.5–6	+5 to +30	1.9	0.5	2, 3, 6	I, M	P	Quad Low Cost, Low Power

Boldface Type: Product recommended or new design.
*New product.

Operational Amplifiers

Precision Amplifiers

Model	V_{OS} μV max	V_{OS} TC μV/°C max	Noise μV p-p 0.1–10 Hz typ	GBW MHz typ	Slew Rate V/μs typ	I_B nA max	CMRR dB f = 1 kHz typ	Package Options	Temp Range	Page	Comments
OP-177	10–60	0.1–1.2	0.35	0.6	0.3	1.5–2.8	110	2, 3, 6	I, M	P	Highest Precision
AD707	15–90	0.1–1.0	0.23	0.9	0.3	1.0–2.5	100	2, 3, 6, 7	C, I, M	L	High Precision
OP-77	25–100	0.3–1.2	0.35	0.6	0.3	2–2.8	105	2, 3, 4, 6, 7	C, I, M	P	Next Generation OP-07
OP-50	25–100	0.3–1	0.12	25	3	5–10	85	3	I, M	P	Low Noise, High Output Current $A_{VCL} \geq 5$
AD708	30–100	0.3–1.0	0.23	0.9	0.3	1.0–2.5	100	2, 3, 6, 7	C, I, M	L	Dual AD707
AD705	25–90	0.6–1.2	0.5	0.8	0.15	0.1–0.15	110	2, 3, 6	C, I, M	L	Low I_B Precision Bipolar
OP-97	25–75	0.6–2	0.5	0.9	0.2	0.1–0.15	100	2, 3, 4, 6, 7	I, M	P	Low Power OP-07
OP-27	25–100	0.6–1.8	0.08	8	2.8	40–80	125	2, 3, 4, 6, 7	C, I, M	P	Low Noise, Precision
AD OP-27	25–100	0.6–1.8	0.08	8	2.8	40–80	123	2, 3, 7	C, I, M	L	Ultralow Noise
OP-37	25–100	0.6–1.8	0.08	63	17	40–80	125	2, 3, 4, 6, 7	C, I, M	P	Fast, Low Noise, Precision $A_{VCL} \geq 5$
AD OP-37	25–100	0.6–1.8	0.08	63 (GBP)	17	40–80	123	2, 3, 7	C, I, M	L	Combines Precision and Speed
AD OP-07	25–150	0.6–2.5	0.35	0.6	0.17	2–12	95	2, 3, 6, 7	C, M	L	Improved Industry Standard
OP-07	25–150	0.6–2.5	0.35	0.6	0.3	2–12	98	2, 3, 4, 6, 7	C, I, M	P	Low Offset Voltage
AD846	25–200	0.8–5.5	—	75	450	450	—	2, 3	C, I, M	L	High Precision, High Speed
PM-1012	35–50	1.5	0.5	0.5	0.2	0.1–0.15	100	2, 3, 6, 7	C, I, M	P	Low Power, Low I_B
AD706	50–100	0.6–1.5	0.5	0.8	0.15	0.15–0.25	110	2, 3, 6	C, I, M	L	Dual AD705
AD704	50–100	1.0–1.5	0.5	0.8	0.15	0.15–0.25	110	2, 3, 6	C, I, M	L	Quad AD705
AD517	50–100	1.3–3	2	0.25	0.1	0.25–2	94	7	C, M	L	
OP-297	50–200	0.6–2	0.3	0.5	0.15	0.1–0.2	105	2, 3, 6	I, M	P	Dual Precision, Low Power, Low I_B
*OP-497	50–150	0.5–1.5	0.3	0.5	0.15	0.1–0.2	130	2, 3, 4, 6	I, M	D	Quad Precision, Low I_B
AD844	50–300	1–5	—	60	2000	450	—	2, 3, 6	I, M	L	Precision, High Speed
OP-200	75–200	0.5–2	0.5	0.5	0.15	2–5	110	2, 3, 4, 6	I, M	P	Dual Monolithic, Precision
OP-270	75–250	1–3	0.08	5	2.4	20–60	115	2, 3, 4, 6	I, M	P	Dual Monolithic, Low Power
OP-227	80–180	1–1.8	0.08	8	2.8	40–80	125	3	I, M	P	Dual Matched, Low Noise
OP-207	100–200	1.3–1.8	0.35	0.6	0.2	3–7	98	3	C, M	P	Dual Matched, Precision
OP-21	100–500	1–5	—	0.6	0.25	100–150	60	2, 3, 6, 7	I, M	P	Low Power, Single Supply
PM-1008	120	1.5	0.5	0.5	0.2	0.1	100	2, 3, 7	C, M	P	Low I_B, Low Power
OP-400	150–300	1.2–2.5	0.5	0.5	0.15	3–7	110	2, 3, 4, 6	C, I, M	P	Quad, Monolithic, Precision
OP-90	150–450	2–5	3	—	—	15–25	80	2, 3, 4, 6	I, M	P	Micropower, Low Voltage, Single Supply
OP-221	150–500	1.5–3	—	0.6	0.3	80–120	60	2, 3, 6, 7	C, I, M	P	Dual Low Power, Single Supply
OP-220	150–750	1.5–3	—	0.2	0.05	20–30	30	2, 3, 6, 7	C, I, M	P	Dual Micropower, Single Supply
OP-271	200–400	2–5	—	5	8.5	20–60	125	2, 3, 4, 6	I, M	P	Dual, Fast, Low Noise
OP-290	200–500	3–5	3	0.02	—	15–25	100	2, 3, 4, 6	I, M	P	Dual Micropower, Low Voltage Single Supply

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Model	V_{OS} μV max	V_{OS} TC μV/°C max	Noise μV p-p 0.1–10 Hz typ	GBW MHz typ	Slew Rate V/μs typ	I_B nA max	CMRR dB f = 1 kHz typ	Package Options	Temp Range	Page	Comments
AD547	250–1000	1–5	2	1	3	0.025–0.05	60	7	C, M	L	Low Drift BiFET
AD647	250–1000	2.5–10	4	1	3	0.035	76	4, 7	C, M	L	Dual AD547
OP-20	**250–1000**	**1.5–7**	**—**	**0.1**	**0.05**	**25–40**	**30**	**2, 3, 6, 7**	**C, I, M**	**P**	**Micropower, Single Supply**
OP-43	**250–1500**	**5–10**	**—**	**2.4**	**6**	**0.005–0.02**	**100**	**2, 7**	**C, I, M**	**P**	**Low I_B, Fast**
AD548	**250–2000**	**2–20**	**2**	**1**	**1.8**	**0.03–0.015**	**83**	**2, 3, 6, 7**	**C, I, M**	**L**	**Low Power BiFET**
AD648	**100–2000**	**3–20**	**2**	**1**	**1.8**	**0.03–0.015**	**83**	**2, 3, 6, 7**	**C, I, M**	**L**	**Dual AD548**
OP-41	**250–2000**	**5–10**	**—**	**0.5**	**1.3**	**0.005–0.02**	**100**	**2, 6, 7**	**C, I, M**	**P**	**Low I_B**
OP-22	**300–1000**	**1.5–3**	**—**	**0.25**	**0.08**	**5–10**	**60**	**2, 3, 6, 7**	**C, I, M**	**P**	**Micropower, Programmable**
OP-32	**300–1000**	**1.5–3**	**—**	**4.5**	**1.5**	**5–10**	**90**	**2, 3**	**C, I, M**	**P**	**Micropower, Fast, Programmable**
OP-470	**400–1000**	**2–4**	**0.08**	**6**	**2**	**25–60**	**110**	**2, 3, 4, 6**	**C, I, M**	**P**	**Quad, Low Noise**
OP-471	**800–1800**	**4–7**	**0.25**	**6.5**	**8**	**25–60**	**108**	**2, 3, 4, 6**	**C, I, M**	**P**	**Quad, Fast, Low Noise**

Boldface Type: Product recommended for new design.
*New product.

Low Cost, General Purpose Amplifiers

Model	V_{OS} mV max	V_{OS} TC µV/°C max	I_B nA max	BW MHz typ[1]	SR V/µs typ	Settling Time µs 0.01% typ	Noise µV p-p 0.1–10 Hz typ	Package Options	Temp Range	Page	Comments
OP-177	**0.01–0.06**	**0.1–1.2**	**1.5–2.8**	**0.6**	**0.3**	**—**	**0.35**	**2, 3, 6**	**I, M**	**P**	**Highest Precision Performance**
AD707	**0.015–0.09**	**0.1–1**	**1–2.5**	**0.9**	**0.15**	**—**	**0.23**	**2, 3, 6, 7**	**C, I, M**	**L**	**Very High DC Precision**
AD705	**0.025–0.09**	**0.6–2.0**	**0.1–0.15**	**0.8**	**0.15**	**—**	**0.5**	**2, 3, 6**	**C, I, M**	**L**	**Low I_B Precision Bipolar**
AD704	**0.05–0.10**	**0.6–1.5**	**0.15–0.25**	**0.8**	**0.15**	**8**	**0.5**	**2, 3, 6**	**C, I, M**	**L**	**Quad AD705**
AD706	**0.05–0.10**	**1.0–1.5**	**0.15–0.25**	**0.8**	**0.15**	**8**	**0.5**	**2, 3, 6**	**C, I, M**	**L**	**Dual AD705**
***OP-497**	**0.05–0.15**	**.5–1.5**	**0.1–0.2**	**0.5**	**0.15**	**—**	**0.3**	**2, 3, 4, 6**	**I, M**	**D**	**Quad OP-97**
OP-77	**0.025–0.1**	**0.3–1.2**	**2–2.8**	**0.6**	**0.3**	**—**	**0.35**	**2, 3, 4, 6, 7**	**C, I, M**	**P**	**Next Generation OP-07**
AD OP-07	**0.025–0.15**	**0.6–2.5**	**3–12**	**0.6**	**0.17**	**—**	**0.35–0.38**	**2, 3, 6, 7**	**C, M**	**L**	**Improved Industry Standard**
OP-07	**0.025–0.15**	**0.6–2.5**	**2–12**	**0.6**	**0.3**	**—**	**0.35**	**2, 3, 4, 6, 7**	**C, I, M**	**P**	**Industry Standard Precision**
OP-97	**0.025–0.2**	**0.6–2**	**0.1–0.15**	**0.9**	**0.2**	**—**	**0.5**	**2, 3, 4, 6, 7**	**I, M**	**P**	**Low Power, Low I_B OP-07**
PM-1012	**0.035–0.05**	**1.5**	**0.1–0.15**	**0.5**	**0.2**	**—**	**0.5**	**2, 3, 6, 7**	**I, M**	**P**	**Low Power, Low I_B**
AD711	**0.025–2**	**3–20**	**0.025–0.05**	**4**	**20**	**1**	**2**	**2, 3, 6, 7**	**C, I, M**	**L**	**Excellent Combination of AC and DC Performance at Very Competitive Prices**
PM-1008	**0.12**	**1.5**	**0.1**	**0.5**	**0.2**	**—**	**0.5**	**2, 3, 7**	**C, M**	**P**	**Low Power Precision**
OP-05	**0.15–1.3**	**0.9–2**	**2–3**	**0.6**	**0.3**	**—**	**0.35**	**2, 3, 7**	**C, M**	**P**	**Instrumentation Operational Amplifier**
AD548	**0.25–2**	**2–20**	**0.01–0.02**	**1**	**1.8**	**8**	**2**	**2, 3, 6, 7**	**C, I, M**	**L**	**Low Power, High Performance**
AD542	0.5–2	5–20	0.025–0.05	1	3	—	2	7	C, M	L	High Performance BiFET
AD544	0.5–2	5–20	0.025–0.05	2	13	—	2	7	C, M	L	High Performance BiFET
OP-02	**0.5–5**	**8–10**	**30–100**	**1.3**	**0.5**	**—**	**0.65**	**2, 3, 7**	**C, M**	**P**	**Improved "741"**
OP-11	**0.5–5**	**10–15**	**300–500**	**3**	**1**	**—**	**0.7**	**2, 3, 4, 6**	**C, I, M**	**P**	**Improved Quad "741"**
OP-09	**0.5–5**	**10–15**	**300–500**	**3**	**1**	**—**	**0.7**	**3**	**C, M**	**P**	**Improved "4136," Quad**
OP-01	**0.7–5**	**8–20**	**30–100**	**2.5**	**18**	**—**	**—**	**2, 3, 7**	**C, M**	**P**	**Inverting, High Speed**
OP-04	**0.75–5**	**8–20**	**50–100**	**1.3**	**0.5**	**—**	**0.65**	**3, 7**	**I, M**	**P**	**Improved "747"**
OP-14	**0.75–5**	**8–20**	**50–100**	**1.3**	**0.5**	**—**	**0.65**	**2, 3, 6, 7**	**I, M**	**P**	**Improved "1458," Dual**
***OP-282**	**1.5**	**10**	**0.1**	**4**	**9**	**—**	**1.3**	**2, 3, 6**	**I**	**D**	**Dual, High Speed, Low Power**
***OP-482**	**2.5**	**10**	**0.1**	**4**	**9**	**—**	**1.3**	**2, 3, 6**	**I**	**D**	**Quad, High Speed, Low Power**
AD741	3–6	20	200–500	1	0.5	—	—	2, 7	C, I, M	L	Improved Second Source

When contacting suppliers, say you saw it in IC MASTER

Low Power/Micropower Amplifiers

Model	ISY max mA	V_{OS} max mV	I_B max nA	GBW typ MHz	SR typ V/μs	Package Option	Temp Range	Page	Comments
OP-22	0.0002–0.4	0.3–1	5–10	0.25	0.08	2, 3, 6, 7	I, M	P	Programmable, Single Supply
OP-32	0.0005–2	0.3–1	5–10	4.5	1.5	2, 3	I, M	P	Fast, Programmable $A_{VCL} \geq 10$, Single Supply
OP-90	0.02	0.15–0.45	15–25	0.02	—	2, 3, 4, 6	I, M	P	Micropower, Low Voltage Single Supply
OP-290	0.04	0.2–0.5	15–25	0.02	—	2, 3, 4, 6	I, M	P	Dual, Micropower, Low Voltage, Single Supply
OP-20	0.08	0.25–1	25–40	0.1	0.05	2, 3, 4, 6	I, M	P	Micropower, Single Supply, Low Cost
OP-490	0.08	0.5–1	15–25	0.02	—	2, 3, 4, 6	I, M	P	Quad, Micropower, Low Voltage, Single Supply
OP-220	0.17	0.15–0.75	20–30	0.2	0.05	2, 3, 6, 7	I, M	P	Dual, Low Cost, Micropower, Single Supply
AD548	0.2	0.25–0.2	0.01–0.02	1.0	1.8	2, 3, 7	C, I, M	L	Precision Low Power BiFET Op Amp
OP-80	0.325	1.5	0.00025–0.001	0.3	0.4	2, 6, 7	I, M	P	Low I_B, CMOS
OP-420	0.36	2.5–6	20–40	0.15	0.05	2, 3, 4, 6	I, M	P	Quad, Low Cost, Micropower, Single Supply
OP-21	0.3–0.4	0.1–0.5	100–150	0.6	0.25	2, 3, 6, 7	I, M	P	Low Cost, Low Power, Single Supply
*OP-282	0.5	2.0	0.1	4	9	2, 3, 6	I	D	Dual, High Speed
AD648	0.4	0.4–2.0	0.005–.01	1.0	1.8	2, 3, 7	C, I, M	L	Dual, Precision Low Power BiFET Op Amp
PM-1008	0.6	0.12	0.1	3.5	0.2	2, 3, 6, 7	C, M	P	Low Power
OP-97	0.6	0.025–0.075	0.1–0.15	0.9	0.2	2, 3, 4, 6, 7	I, M	P	Precision, Low I_B
AD705	0.6	0.025–0.09	0.1–0.15	0.8	0.15	2, 3, 6	C, I, M	L	Picoampere Input Current Bipolar Op Amp
PM-1012	0.6	0.035–0.05	0.1–0.15	0.5	0.2	2, 3, 6, 7	C, I, M	P	Precision, Low I_B
OP-221	0.8	0.15–0.5	80–120	0.6	0.3	2, 3, 6, 7	I, M	P	Dual, Low Cost, Low Power, Single Supply
OP-41	1	0.25–2	0.005–0.02	0.5	1.3	2, 6, 7	I, M	P	Low Power, Low I_B
*OP-482	1.0	3.0	0.1	4	9	2, 3, 6	I	D	Quad, High Speed
OP-43	1–1.2	0.25–1.5	0.005–0.025	2.4	6	2, 7	I, M	P	Fast, Low Power, Low I_B
AD706	1.2	0.05–0.1	0.11–0.2	0.8	0.15	2, 3, 6	C, I, M	L	Dual, Picoampere Input Current Bipolar Op Amp
*OP-297	1.25	0.05–0.2	0.1–0.2	0.5	0.15	2, 3, 4, 6	I, M	D	Dual, Precision, Low I_B
OP-200	1.45	0.075–0.2	2–5	0.5	0.15	2, 3, 4, 6	I, M	P	Dual, Precision
OP-421	1.8	2.5–6	50–150	1.9	0.5	2, 3, 6	I, M	P	Quad, Low Cost, Low Power, Single Supply
AD704	2.4	0.075–0.150	0.15—0.17	1.0	0.15	2, 3, 6	C, I, M	D	Quad, Picoampere Input Current Bipolar Op Amp
OP-400	2.9	0.15–0.3	3–7	0.5	0.15	2, 3, 4, 6	C, I, M	P	Quad, Precision

[1]Unity gain small signal bandwidth.
Boldface Type: Product recommended for new design.
*New product.

Low Input Current Amplifiers

Model	I_B pA max	Input Impedance Differential Ω‖pF typ	Input Impedance Common Mode Ω‖pF typ	CMRR dB f=1 kHz typ	V_{OS} mV max	V_{OS} TC µV/°C max	BW MHz typ[1]	Package Options	Temp Range	Page	Comments
AD549	**0.06–0.25**	**10^{13}‖1**	**10^{15}‖0.8**	**62**	**0.25–1**	**5–20**	**1**	**7**	**C, M**	**L**	**Monolithic, Lowest I_B**
AD515A	0.075–0.3	10^{13}‖1.6	10^{15}‖0.8	62	1–3	15–50	1	7	C	L	Lower Cost AD515 Replacement
OP-80	**0.25–1**	—		**90**	**1.5**	—	**0.3**	**2, 6, 7**	**I, M**	**P**	**Low Cost CMOS**
AD546	**0.5–1**	**10^{13}‖1**	**10^{15}‖0.8**	**62**	**1–2**	**20**	**1**	**2**	**C**	**L**	**Precision Low Cost Electrometer**
AD645	**1.5–3**	**10^{13}‖1**	**10^{14}‖3**	**94**	**0.25–0.5**	**1–5**	**2**	**2, 7**	**C, I, M**	**L**	**Low Noise, Precision BiFET**
AD545A	1–2	10^{13}‖1.6	10^{15}‖0.8	62	0.25–1	3–25	1	7	C	L	Lower Cost AD545 Replacement
OP-41	**5–20**	—		**98**	**0.25–2**	**5–10**	**0.5**	**2, 6, 7**	**C, I, M**	**P**	**High Stability JFET**
AD548	**10–20**	**10^{12}‖3**	**3×10^{12}‖3**	**84**	**0.25–2**	**2–20**	**1**	**2, 3, 6, 7**	**C, I, M**	**L**	**Low Power, Low Cost**
OP-43	**5–25**	—		**98**	**0.25–1.5**	**5–10**	**2.4**	**2, 7**	**I, M**	**P**	**Low I_B, Fast $A_{VCL} \geq 3$**
AD547	25–50	10^{12}‖6	10^{12}‖13	60	0.25–1	1–5	1	7	C, M	L	Low Drift
AD711	**25–50**	**3×10^{12}‖5.5**	**3×10^{12}‖5.5**	**62**	**0.25–2**	**3–20**	**4**	**2, 3, 6, 7**	**C, I, M**	**L**	**Low Cost BiFET, Excellent AC and DC Performance**
PM-155A	**50**	—		**90**	**2**	**5**	**2.5**	**3, 7**	**C, M**	**P**	**Improved Industry Standard**
PM-156A	**50**	—		**90**	**2**	**5**	**4.5**	**3, 7**	**C, M**	**P**	**Improved Industry Standard**
PM-157A	**50**	—		**90**	**2**	**5**	**20**	**3, 7**	**C, M**	**P**	**Improved Industry Standard**
OP-15	**50–200**	—		**90**	**0.5–3**	**5–15**	**6**	**2, 3, 6, 7**	**C, I, M**	**P**	**Precision BiFET**
OP-16	**50–200**	—		**90**	**0.5–3**	**5–15**	**8**	**2, 3, 6, 7**	**C, I, M**	**P**	**Precision BiFET**
OP-17	**50–200**	—		**90**	**0.5–3**	**5–15**	**30**	**2, 3, 6, 7**	**C, I, M**	**P**	**Fast, Precision BiFET**

Quad Operational Amplifiers

Model	V_{OS} mV max	V_{OS} TC µV/°C max	I_B pA max	BW MHz typ[1]	Slew Rate V/µs typ	Settling Time 0.01% to 0.01% µs typ	Package Options	Temp Ranges	Page	Comments
AD704	**0.05–0.10**	**0.6–1.5**	**150–250**	**0.8**	**0.15**	**—**	**2, 3, 6**	**C, I, M**	**L**	**Quad AD705, Low I_B Precision Bipolar**
***OP-497**	**0.05–0.15**	**0.5–1.5**	**150–200**	**0.5**	**0.15**	**—**	**2, 3, 4, 6**	**I, M**	**D**	**Low Power, Low I_B Precision Bipolar**
OP-400	**0.15–0.3**	**1.2–2.5**	**3–7**	**0.5**	**0.15**	**—**	**2, 3, 4, 6**	**C, I, M**	**P**	**Quad Monolithic, Precision**
OP-470	**0.4–1**	**2–4**	**25–60**	**6**	**2**	**—**	**2, 3, 4, 6**	**C, I, M**	**P**	**Quad Monolithic, Low Noise**
OP-490	**0.5–1**	**5**	**15–25**	**0.02**	**—**	**—**	**2, 3, 4, 6**	**I, M**	**P**	**Micropower, Low Voltage, Single Supply**
AD713	**0.5–1.5**	**20**	**75–150**	**4**	**20**	**1**	**2, 3**	**C, I, M**	**L**	**Superior AC and DC Performance, Quad AD711**
OP-11	**0.5–5**	**10–15**	**300–500**	**3**	**1**	**—**	**2, 3, 4, 6**	**C, I, M**	**P**	**Improved Quad "741"**
OP-471	**0.8–1.8**	**4–7**	**25–60**	**6.5**	**8**	**—**	**2, 3, 4, 6**	**C, I, M**	**P**	**Monolithic, Fast, Low Noise**
***OP-482**	**3.0**	**10**	**0.1**	**4.0**	**9**	**1.5**	**3, 4, 6**	**I**	**D**	**High Speed, Low Power**
PM-148/248	**2.5**	**—**	**75**	**0.8**	**0.4**	**—**	**3**	**I, M**	**P**	**Improved Industry Standard**
OP-421	**2.5–6**	**10–15**	**50–150**	**1.9**	**0.5**	**—**	**2, 3, 6**	**I, M**	**P**	**Low Power, Low Cost, Single Supply**
OP-420	**2.5–6**	**10–25**	**20–40**	**0.15**	**0.05**	**—**	**2, 3, 4, 6**	**I, M**	**P**	**Micropower, Low Cost, Single Supply**

When contacting suppliers, say you saw it in IC MASTER

Dual Operational Amplifiers

Model	V_{OS} mV max	V_{OS} TC µV/°C max	I_B nA max	BW MHz typ[1]	Slew Rate V/µs typ	Settling Time to 0.01% µs typ	Package Options	Temp Range	Page	Comments
AD708	**0.03–0.1**	**0.3–1.0**	**1–2.5**	**0.9**	**0.3**		**2, 3, 7**	**C, I, M**	**L**	**Highest DC Precision; Excellent Matching Between Amps, Dual AD707**
AD706	**0.05–0.10**	**0.6–1.5**	**0.15–0.25**	**0.8**	**0.15**	**—**	**2, 3, 6**	**C, I, M**	**L**	**Dual AD705, Low I_B Precision Bipolar**
***OP-297**	**0.05–0.2**	**0.6–2**	**0.1–0.2**	**0.5**	**0.15**	**—**	**2, 3, 6**	**I, M**	**N**	**Precision, Low Power, Low I_B**
OP-200	**0.075–0.2**	**0.5–2**	**2–5**	**0.5**	**0.15**	**—**	**2, 3, 4, 6**	**I, M**	**P**	**Dual Monolithic, Precision**
OP-270	**0.075–0.25**	**1–3**	**20–60**	**5**	**2.4**	**—**	**2, 3, 4, 6**	**I, M**	**P**	**Dual Monolithic, Low Noise**
OP-227	**0.08–0.18**	**1–1.8**	**40–80**	**8**	**2.8**	**—**	**3**	**I, M**	**P**	**Dual Matched, Low Noise**
OP-207	**0.1–0.2**	**1.3–1.8**	**3–7**	**0.6**	**0.2**	**—**	**3**	**C, M**	**P**	**Dual Matched, Precision**
OP-221	**0.15–0.5**	**1.5–3**	**80–120**	**0.6**	**0.3**	**—**	**2, 3, 6, 7**	**C, I, M**	**P**	**Low Power, Single Supply**
OP-220	**0.15–0.75**	**1.5–3**	**20–30**	**0.2**	**0.05**	**—**	**2, 3, 6, 7**	**C, I, M**	**P**	**Micropower, Single Supply**
OP-271	**0.2–0.4**	**2–5**	**20–60**	**5**	**8.5**	**—**	**2, 3, 4, 6**	**I, M**	**P**	**Dual Monolithic, Fast, Low Noise**
OP-290	**0.2–0.5**	**3–5**	**15–25**	**0.02**	**—**	**—**	**2, 3, 4, 6**	**I, M**	**P**	**Micropower, Low Voltage Single Supply**
AD647	0.25–1	2.5–10	0.035–0.075	1	3	—	4, 7	C, M	L	Dual AD547
AD746	**0.25–1**	**3–20**	**0.15**	**13**	**75**	**0.5**	**2, 3, 7**	**C, I, M**	**L**	**Precision, Fast Settling, Dual AD744**
AD648	**0.3–2**	**3–20**	**0.01–0.02**	**1**	**1.8**	**8**	**2, 3, 7**	**C, I, M**	**L**	**Low Power, BiFET, Dual AD548**
AD712	**0.3–3**	**5–20**	**0.05–0.075**	**4**	**20**	**1**	**2, 3, 6, 7**	**C, I, M**	**L**	**Excellent AC and DC Performance, Dual AD711**
OP-10	**0.5**	**2–4.5**	**3–7**	**0.6**	**0.17**	**—**	**3**	**C, M**	**P**	**Dual Matched, Precision**
SSM-2139	**0.5**	**2.5**	**80**	**30**	**11**	**—**	**2**	**I**	**P**	**Audio, Low Noise**
OP-249	**0.5–0.7**	**5–6**	**0.05–0.075**	**4.7**	**22**	**0.9–0.01**	**2, 3, 4, 6, 7**	**I, M**	**P**	**Fast, Low Distortion**
AD642	0.5–2	—	0.035–0.075	1	3	—	7	C, M	L	Dual AD542
AD644	0.5–2	—	0.035–0.075	2	13	—	7	C, M	L	Dual AD544
OP-14	**0.75–5**	**8–20**	**50–100**	**1.3**	**0.5**	**—**	**2, 3, 6, 7**	**I, M**	**P**	**General Purpose, Low Cost**
OP-215	**1–4**	**10**	**0.1–0.3**	**5.7**	**18**	**0.9–0.1**	**2, 3, 4, 6, 7**	**C, I, M**	**P**	**High Speed, Precision**
***OP-282**	**2.0**	**10**	**0.1**	**4.0**	**9**	**1.5**	**3, 4, 6**	**I**	**D**	**High Speed, Low Power**
AD827	**2.0–4.0**	**15**	**7000**	**50**	**300**	**0.065–0.1**	**2, 3, 6**	**C, I, M**	**L**	**Dual AD847, High Speed, Low Power**
OP-260	**3.5–7**	**10**	**1000–15000**	**90**	**1000**	**0.25–0.1**	**2, 3, 4, 6, 7**	**I, M**	**P**	**High Speed, Current Feedback**

[1]Unity gain small signal bandwidth.
Boldface Type: Product recommended for new design.
*New product.

Operational Amplifiers

Unity Gain Buffers

Model	−3 dB BW MHz typ	SR V/μs min	Settling Time to 0.02% ns typ	Rise Time 1V Step ns typ	I_{OUT} mA min	V_{OS} mV typ	I_{SS} mA max	Package Options	Temp Range	Page	Comments
AD9630	750	1800	8	0.9	50	3	26	2, 3, 6, 12	I, M	L	High Performance, Wide-Band Buffer
AD9620	600	2200	8	0.8	40	2	48	1	I, M	L	High Performance, Low Harmonic Distortion Buffer

Audio Preamplifiers

Model	en typ nV/√Hz 20 kHz BW	TDH typ G=1000 @ 1 kHz %	Slew Rate typ V/μS	BW typ G=100 MHz	Package Option	Temp Range	Page	Comments
SSM-2015	1.3	0.007	8	0.7	2	C	P	Low Noise Microphase Preamp
SSM-2016	0.8	0.009	10	0.65	2	C	P	Lowest Noise, Wide Supply Voltage Range
*SSM-2017	0.85	0.009	14	0.25	2	I	D	Low Cost, 8-Pin DIP

When contacting suppliers, say you saw it in IC MASTER

Instrumentation Amplifiers

Model	Gain Ranges	Gain Error % max	Gain TC ppm/°C max	BW MHz typ[2]	Package Options	Temp Range	Page	Comments
AMP-03	**1**	**0.008**	**—**	**3.0**	**1.7**	**I, M**	**P**	**Precision Unity-Gain Differential Amplifier**
AD526	**1, 2, 4, 8, 16**	**0.01–0.15**	**2–5**	**4.0**	**1, 2**	**C, I, M**	**L**	**Software Programmable, µP Interface**
AD625	**1–10,000**	**0.02–0.05**	**5**	**0.65**	**1, 2**	**C, I, M**	**L**	**Resistor Programmable, Low Cost**
AMP-02	**1–10,000**	**0.02**	**50**	**1.20**	**2, 3, 6**	**I, M**	**P**	**High Accuracy, 8-Pin Package Single Resistor Gain Set**
AD624	**1, 100, 200, 500, 1000**	**0.02–1.0**	**5–25**	**1.0**	**1**	**I, M**	**L**	**Pin Programmable**
AD524	**1, 10, 100, 1000**	**0.02–2.0**	**5–100**	**1.0**	**1, 4**	**I, M**	**L**	**Pin Programmable, Input Protection**
AD365	1, 10, 100, 500	0.05–0.1	5–10	0.8	8	I	L	Digitally Programmable with T/H
AD522	1–10,000	0.05–1.0	2–50	0.3	1	I, M	L	Resistor Programmable
AD521	0.1–1000	0.25–3.0	3–50	2	1	C, M	L	Resistor Programmable
AMP-05	**0.1–2000**	**0.5**	**20**	**3.0**	**3**	**I, M**	**P**	**JFET Input, Fast Settling**
AMP-01	**0.1–1000**	**0.6**	**10**	**0.57**	**3, 4, 6**	**C, I, M**	**P**	**Low Noise, Precision**
SSM-2141	**1**	**0.01**	**—**	**3**	**2**	**I**	**P**	**High Common-Mode Rejection Differential Line Receiver**
***SSM-2142**	**2**	**2**	**—**	**—**	**2**	**I**	**D**	**Balanced Line Driver**
AD620	**1, 1000**	**0.01–0.10**	**50**	**1.0**	**2, 3, 6**	**I, M**	**L**	**Low Cost, 8-Pin SOIC**
AD626	**10, 100**	**0.2**	**150**	**0.1**	**2, 3, 6**	**I, M**	**L**	**Single Supply, High CMV**

Isolation Amplifiers

Model	Peak Volt Iso V pk	Gain Range V/V	Gain Nonlin % max	Freq Resp kHz	Package Options	Temp Range	Page	Comments
284J	2500	1–10	0.05	1	Module	C	L	Medical, Single Channel, Low Cost
286J	2500	1–100	0.05-0.2	1	Module	C	L	Medical, Multichannel, Low Cost
289	2500	1–100	0.012–0.05	20	Module	C	L	Precision, Wide Bandwidth, Synchronized
290A	1500	1–100	0.1–0.25	2.5	Module	I	L	Single Channel, General Purpose
292A	1500	1–100	0.1–0.25	2.5	Module	I	L	Multichannel, General Purpose
AD202	**1000–2000**	**1–100**	**0.025–0.05**	**2**	**2, 11**	**I**	**L**	**Lowest Cost, Small Size, Single Channel, −40°C to +85°C**
AD203	**2000**	**1–100**	**0.025**	**10**	**2**	**M**	**L**	**Rugged, Military Temperature Range, Wide Bandwidth**
AD204	**1000–2000**	**1–100**	**0.025-0.05**	**5**	**2, 11**	**I**	**L**	**Lowest Cost, Small Size, Multichannel, −40°C to +85°C**
AD206	**2000**	**1–10**	**0.015–0.03**	**100 kHz**	**11**	**I**	**L**	**100 kHz Bandwidth, Low Distortion Isolation Amplifier**
AD208	**1000–2000**	**1–1000**	**0.015–0.03**	**0.4–4 kHz**	**11**	**I**	**L**	**Precision, Low Cost, Single Channel, mV Input**
AD210	**3500**	**1–100**	**0.012–0.025**	**20**	**2**	**I**	**L**	**Precision, 3-Port Isolation, Wide Bandwidth**
AD295	2500	1–1000	0.012–0.05	4.5	2	I	L	−40°C to +100°C, Low Drift, 3-Port Isolation
281					Module	C	L	External Oscillator for 286J and 292A Isolation Amplifiers
AD246					2, 11	C	L	External Oscillator for AD204 and AD208 Isolation Amplifiers

[1]Temperature Range: −10°C to +55°C for SSM-2015, −25°C to +55°C for SSM-2016, and −40°C to +85°C for SSM-2017.
[2]Unity gain small signal bandwidth.
Boldface Type: Product recommended for new design.
*New product.

Analog Multipliers/Dividers

Multipliers/Dividers

Model	BW MHz typ[1]	Total Error % FS max	Accuracy vs Temp %/°C typ	Package Options	Temp Range	Page	Comments
AD834	**>500**	**2**		**2, 3, 6**	**C, I, M**	**L**	**Very High Speed 4-Quad Mult/Div**
AD539	**60**	**1.5–2.5**	**1–2% (T_{min}–T_{max})**	**1, 2**	**C, M**	**L**	**High Speed 2-Channel, 2-Quad Mult/Div**
AD734	**10**	**0.25–0.04**	**0.003**	**2, 3**	**I, M**	**N**	**High Accuracy Replacement for AD534**
AD633	**1**	**2**		**2, 6**	**C**	**N**	**Low Cost 4-Quad Multiplier**
AD534	**1**	**0.25–1.0**	**0.0008–0.022**	**1, 4, 7**	**C, M**	**L**	**High Accuracy 4 Quad Mult/Div**
AD632	1	0.5–1.0	0.01–0.02	1, 7	I, M	L	High Accuracy Replacement for AD532
AD532	1	1–2	0.01–0.04	1, 4, 7	C, M	L	Accurate 4-Quad Mult/Div
AD538	0.4	0.5–1.0		1	I, M	L	Simultaneous Mult/Div/Exponentiator
AD535	0.02	0.5–5.0	0.01–0.05	1, 7	C	N	Dedicated Divider

Modulator/Demodulator

Model	Unity Gain BW MHz[1]	Gain	Slew Rate V/μs	Package Options	Temp Range	Page	Comments
AD630	**2**	**±1, ±2**	**45**	**1, 2, 4**	**C, I, M**	**L**	**Balance Modulator/Demodulator with 10 V FS Output**

Signal Compression Components

Model	Input Range	Log Conformity RTI	BW kHz	Package Options	Temp Range	Page	Comments
755	1 nA–1 mA	0.5%	10	Module	I	L	Complete, Current and Voltage, 6 Decade, High Accuracy
757	1 nA–1 mA	0.5%	25	Module	I	L	Complete, Log/Antilog Ratio, 6 Decade, High Accuracy
759	20 nA–0.2 mA	1.0%	200	Module	I	L	Complete, Current and Voltage, 4 Decade, Lowest Cost
SSM-2100	**10 nA–1 mA**	**0.4%**	**2**	**2**	**C**	**P**	**Internal Temperature Regulator**
AD9521	**0.4 V p–p**	**±1 dB**	**10–250 MHz**	**4, 7**	**C, M**	**L**	**Wideband Amplifier with Logarithmic Detected Output**
AD640	**0.75 mV–200 mV**	**±0.6 dB**	**120 MHz**	**1, 2, 4, 5**	**C, I, M**	**L**	**120 MHz, 50 dB, DC Demodulating Logarithmic Amplifier**
***AD600**	**±2 V**	**±0.5 dB**	**30 MHz**	**2, 6**	**C**	**D**	**Dual 0 to +40 dB Variable Gain Amplifiers**
***AD602**	**±2 V**	**±0.5 dB**	**30 MHz**	**2, 6**	**C**	**D**	**Dual −10 dB to +30 dB Variable Gain Amplifiers**

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RMS-to-DC Converters

Model	Conversion Accuracy mV ±%Read max	Full-Scale Range V RMS	dB Output Error dB max	Package Options	Temp Range	Page	Comments
AD737	**(0.2±0.3)–(0.4±0.5)**	**0.2**		**2, 3, 6**	**C, I**	**L**	**Low Cost, Low Power, No Output Buffer**
AD736	**(0.3±0.3)–(0.5±0.5)**	**0.2**		**2, 3, 6**	**C, I**	**L**	**General Purpose, Low Cost, Low Power**
AD636	(0.2±0.3)–(0.5±0.6)	0.2	0.2–0.5	1, 7	C	L	Low Power
AD637	**(0.5±0.2)–(1±0.5)**	**7**	**0.3 (typ)**	**1, 3, 6**	**C, M**	**L**	**High Accuracy, Wide Bandwidth**
AD536A	(2±0.2)–(5±0.5)	7	0.3–0.6	1, 3, 4, 7	C, M	L	General Purpose
SSM-2110	**0.2±0.012**	**7**	**0.5**	**2**	**C**	**P**	**High Accuracy, Wide Dynamic Range**

Special Function Components

Model	Description	Package Options	Temp Range	Page
AD639	Universal Trigonometric Function Converter	1	I, M	L
AD9500	**Digitally Programmable Delay Generator**	**3, 4, 5**	**I, M**	**L**
AD9501	**TTL/CMOS Digitally Programmable Delay Generator**	**2, 4, 5**	**C, M**	**L**
***AD9505**	**60 MHz "On the Fly" Programmable Delay Generator**	**5**	**C**	**D**
PKD-01	**Monolithic Peak Detector with Reset-and-Hold Mode**	**2, 3**	**C, M**	**P**

Temperature Transducers

Model	I_{OUT} µA/K	Cal Error °C max	Nonlin °C max	Package Options	Temp Range	Page	Comments
AC2626	**1**	**0.5–5**	**0.3–1.5**	**3/16" Stainless Steel Sheath**	**C, M**	**L**	**General Purpose Temperature Probe 4" and 6" Length**
AD590	**1**	**0.5–5**	**0.3–1.5**	**7, 9**	**M+**	**L**	**Wide Temperature Range, Accurate**
AD592	**1**	**0.5–2.5**	**0.15–0.35**	**2**	**I+**	**L**	**Low Cost, Accurate**
AD592	**1**	**0.5–2.5**	**0.15–0.35**	**2**	**I+**	**L**	**Low Cost, Accurate**

[1]Unity gain small signal bandwidth.
Boldface Type: Product recommended for new design.
*New product.

Analog Devices

Signal Conditioning Components & Subsystems

Model	V/I Transmitters: Loop Power	V/I Transmitters: Local Power	Isolated	Sensor Excitation	Sensor Type(s)	IC	Hybrid Package	Hybrid Module	Page
AD594/AD595					**Thermocouple**	**X**			**L**
AD596/AD597					**Thermocouple**	**X**			**L**
AD598				**X**	**LVDT**	**X**			**L**
AD693	**X**	**X**		**X**	**mV: All**	**X**			**L**
AD694		**X**		**X**	**0–2 or 10 V Input Range**	**X**			**L**
1B21	**X**		**X**		**V–I**			**X**	**L**
1B22		**X**	**X**		**V–I**			**X**	**L**
1B31				**X**	**Strain Gage**		**X**		**L**
1B32				**X**	**Strain Gage**		**X**		**L**
1B41			**X**	**X**	**RTD**			**X**	**L**
1B51			**X**		**Thermocouple, mV**			**X**	**L**
AC1226			**Thermocouple Cold Junction Compensator**				**X**		**L**
2B20		X			V–I			X	L
2B22		X	X		V–I			X	L
2B23		X	X		V–I			X	L
2B24	X		X		I–I			X	N
2B30					Strain Gage, RTD			X	L
2B31				X	Strain Gage, RTD			X	L
2B50			X		Thermocouple, mV			X	L
2B52	X		X		Thermocouple, mV			X	N
2B53	X				Thermocouple, mV			X	N
2B54/2B55			X		Thermocouple, mV, 4-Channel			X	L
2B57	X			X	Solid State (AD590)			X	N
2B58				X	3-Wire RTD			X	N
2B59	X			X	3-Wire RTD			X	N
3B Series	**Modular Signal Conditioning Subsystem, Flexible, User Configurable**								**L**
4B Series	Alarm Limit Subsystem								N
5B Series	**Modular Signal Conditioning Subsystem; System Applications**								**L**
6B Series	**Software Configurable, Digitizing Signal Conditioning Subsystem**								**L**
7B Series	**Low Cost, Modular Process Control Signal Conditioners**								**L**

Model	Digits	FS Range	Data Output	Display Type	Page	Comments
AD2026	3	−99 mV to +999 mV	N/A	LED	C I	+5 V Power
AD2010	3 1/2	±199.9 mV	BCD	LED	C I	+5 V Power
AD2021	3 1/2	±199.9 mV, ±1.999 V, ±19.99 V	Serial	LED	C I	+5 V Power

Digital Signal Processing Components

DSP Processor Key Feature Summary

Model	Inst Cycle Time ns	Off-Chip Harvard Arch	Internal Program Memory RAM	Internal Data Memory RAM	Internal Program Cache Word	Program Memory Boot	Serial Ports	8/16-Bit Host Interface Port	Program Timer	On-Chip A/D and D/A	Ext Interrupts	Low Power Modes	Pin Count	Package Options
16-Bit Fixed-Point														
ADSP-2100A	80	√	—	—	16 × 24	—	—	—	—	—	4	—	100	9, 10, 15,
ADSP-2101	60	—	2K × 24	1K × 16	—	√	2	—	√	—	3	1	68	5, 15
ADSP-2102	60	—	2K × 24[1]	1K × 16	—	√	2	—	√	—	3	1	68	5, 15
ADSP-2105	100	—	1K × 24	0.5K × 16	—	√	1	—	√	—	3	1	68	5
ADSP-2106	100	—	1K × 24[1]	0.5K × 16	—	√	1	—	√	—	3	1	68	5
ADSP-2111	60	—	2K × 24	1K × 16	—	√	2	√	√	—	3	1	100	10, 15
ADSP-2112	60	—	2K × 24[1]	1K × 16	—	√	2	√	√	—	3	1	100	10, 15
ADSP-21msp50	77	—	2K × 24	1K × 16	—	√	2	√	√	√	3	2	132/144	10/15
ADSP-21msp51	77	—	2K × 24[1] & 2K × 24 ROM	1K × 16	—	√	2	√	√	√	3	2	132/144	10/15
32/40-Bit Floating-Point														
ADSP-21020	40	√	—	—	32 × 48	—	—	—	√	—	4	1	223	15, 17

[1]RAM/ROM.

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3349

Data Acquisition Subsystems

Model	Resolution Bits	Throughput Rate kHz	No. Channels	Bus Interface	Package Options	Temp Range	Page	Comments
*AD1341	12	150	16/8	16	12	C, M	C II	Complete, Programmable DAS with Fast Bus Interface
AD1332	12	125	1	12	1	I, M	C II	Complete 12-Bit 125 kHz Sampling ADC, On-Chip FIFO
AD1334	12	65	4	12	1	I, M	C II	Four-Channel 12-Bit Sampling ADC, On-Chip FIFO
AD364	12	20	16/8	12	1	C, M	C II	High Speed 16-Channel 12-Bit DAS
AD363	12	25	16/8	12	1	C, M	C II	16-Channel 12-Bit DAS
AD1362			16/8			C, M	C II	16-Channel Analog Front-End for 12-Bit ADC
AD7850	12	10	1	Serial	2, 5	C	C II	Small Signal DAS with Instrumentation Amplifiers and Reference
DAS1152	14	25	1	14	1	I	C II	14-Bit High Accuracy Sampling ADC
DAS1157	14	18	1	14	1	I	C II	Low Power 16-Bit Sampling ADC
DAS1153	15	25	1	15	1	I	C II	15-Bit High Accuracy Sampling ADC
DAS1158	15	18	1	15	1	I	C II	Low Power 15-Bit Sampling ADC
DAS1159	16	18	1	16	1	I	C II	Low Power 16-Bit Sampling ADC
AD7716	20	0.30	1	Serial	2, 6	C	C II	Quad 20-Bit Sigma Delta ADC, Low Power

Complete Analog I/O Ports

General Purpose

Model	Resolution Bits	Conv Time max µs	SHA BW kHz typ	Settling Time µs	Ref. Volt Int/Ext	Bus Interface	Package Options	Temp Range	Page	Comments
AD7569	8	2	500	1	Int	8, µP	2, 3, 4, 5, 6	C, I, M	C II	CMOS, Complete I/O Port with DAC, ADC, SHA, Amps and Reference
AD7669	8	2	500	1	Int	8, µP	2, 5, 6	C, I, M	C II	CMOS, Complete I/O Port with 2 DACs, ADC, SHA, Amps, and Reference
AD7769	8	3	500	2.5	Ext	8, µP	2, 5	C	C II	CMOS, Two-Channel ADC/DAC with Output Amplifiers
*AD7868	12	10	500	3	+3 V, Int	Serial, µP	2, 3, 6	I, M	C II	CMOS, Complete I/O Port with 12-Bit ADC and 12-Bit DAC
*AD7869	14	10	500	3.5	+3 V, Int	Serial, µP	2, 3, 6	C, I, M	C II	CMOS, Complete I/O Port with 14-Bit ADC and 14-Bit DAC

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Complete Analog I/O Ports

Disk Drive Servo

Model	ADC Resolution Bits	Conv Time max µs	DACs Resolution Bits	Settling Time µs	Ref. Volt Int/Ext	Bus Interface	Package Options	Temp Range	Page	Comments
***AD7774**	**8**	**3**	**8** **11**	**4** **8**	**Int/Ext**	**8, µP**	**2, 5**	**C**	**C II**	**CMOS, I/O Port with 4-Channel, 8-Bit ADC, 11-Bit and Two 8-Bit DACs**
***AD7773**	**10**	**3**	**8** **10**	**3** **4**	**2.1 V, Int**	**10, µP**	**6**	**C**	**C II**	**Complete Embedded Servo Front End for Hard Disk Drive with Separate Address and Data Pins**
***AD7775**	**10**	**3**	**8** **10**	**3** **4**	**2.1 V, Int**	**10, µP**	**6**	**C**	**C II**	**Same as the AD7773 Except with Multiplexed Address/Data Bus**

Communications

Model	DAC/ADC Resolution Bits	DAC/ADC SNR + THD dB	Through-put kSPS	Ref. Volt Int/Ext	Bus Interface	Package Options	Temp Range	Page	Comments
***AD7001**	**10/8**	**56/44**	**2170**	**2.5 V, Int**	**10, 8 Serial, µP**	**10**	**C[1]**	**C I**	**GSM Baseband I/O Port**
***AD7002**	**10/12**	**—/62**	**4333 (DAC)** **541.7 (ADC)**	**2.5 V, Int**	**Serial, µP**	**10**	**C[1]**	**C I**	**GSM Baseband I/O Port with On-Board GMSK Modulator**
***AD7005**	**10/12**	**—/62**	**97.2 (DAC)** **194.4 (ADC)**	**2.3 V, Int**	**Serial, µP**	**10**	**C[1]**	**C I**	**TIA Baseband I/O Port**
***AD28msp02**	**16/16**	**65/65**	**8**	**2.5 V, Int**	**Serial, µP**	**6**	**C**	**C I**	**Complete Voice Band Linear Codec with On-Chip Filtering**
***AD28msp01**	**16/16**	**80/80**	**7.2/8.0/9.6**	**2.5 V, Int**	**Serial, µP**	**6**	**C**	**C I**	**Complete Analog Front End for High Performance DSP-Based Modems**

[1]Operates to −25°C.
*Boldface type: Product recommended for new design.
*New product.

ATE Components

Pin Drivers

Model	Speed MHz	V_{RANGE}	Slew Rate at 5 V (V/ns)	Output Capacitance pF	Linearity % of V_{REF}	Package Options	Temp Range	Page
AD1322B	200	−2 V to 7 V	1.8	3.5	0.15	12	C	L
AD1322	200	−2 V to 7 V	1.6	8	0.5	12	C	L
AD1321	100	−2 V to 7 V	1.25	8	0.5	12	C	L
*AD1320	40	−2 V to 7 V	0.5	20	0.5	3	C	D

Comparators

Model	Prop Delay ns	Common-Mode Range	Dispersion ps	Input Capacitance pF typ	Input Offset mv max	Package Options	Temp Range	Page
AD1317	2.5	−2 V to 7 V	250	2 (max)	±10	12	C	L
AD96685	3.5	−2.5 V to 5 V	50	2	2	3, 4, 5, 7	I, M	L
AD96687‡	3.5	−2.5 V to 5 V	50	2	2	3, 4, 5	I, M	L
AD9696	7.0	−2.2 V to 3.7 V	100	3	2	2, 3, 6, 7	C, M	L
AD9698‡	7.0	−2.2 V to 3.7 V	100	3	2	2, 3, 6	C, M	L

Active Load

Model	Prop Delay ns	Program Current mA	Input Leakage nA	V_{OUT} Capacitance pF	Package Options	Temp Range	Page
AD1315	1.5	±50	±200	2	12	C	L

Delay Generators

Model	Description	Package Options	Temp	Page
AD9500	ECL Digitally Programmable	3, 4, 5	C, M	L
AD9501	TTL/CMOS Digitally Programmable	2, 3, 5	C, M	L
*AD9505	60 MHz "On the Fly" Programmable Delay Generator	5	C	D

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Disk Drive Components

Optical Storage Component

Model	Description	Package Options	Temp	Page
AD880	**Optical Disk Drive Data/Servo Channel Processor**	**6**	**C**	**L**

Magnetic Storage Components

Model	Description	Package Options	Temp	Page
AD890	**Precision, Wideband Channel Processing Element**	**3, 5**	**C**	**L**
AD891	**Rigid Disk Data Channel Qualifier**	**3, 5**	**C**	**L**
AD891A	**50 Mb/s Rigid Disk Data Qualifier**	**5**	**C**	**L**
AD892T/E	**30 Mb/s Peak Detector**	**5**	**C**	**L**
AD897	**40 Mb/s Fully Integrated Disk Drive Read Channel**	**10**	**C**	**L**

Servo Components§

Model	Description	Package Options	Temp	Page
AD7569	Complete, 8-Bit Analog I/O Port with DAC, ADC, SHA, Amps, and Reference	2, 3, 4, 5	C, I, M	C
AD7669	Complete, 8-Bit Analog I/O Port with 2 DACs, ADC, SHA, Amps, and Reference	2, 5	C, I, M	C
AD7769	8-Bit Analog I/O Port with Two-Channel ADC/DAC	2, 5	C	C

Automotive Components

Model	Description	Package Options	Temp Range	Page
***AD22001**	**5-Channel Monolithic Comparator for Lamp Monitoring**	**2**	**−40°C to +125°C**	**D**
***AD22050**	**Single-Supply Sensor Interface Circuit**	**2**	**−40°C to +125°C**	**D**
***AD22100**	**Monolithic Temperature Sensor with Signal Conditioning**	**2, 7, 11**	**−50°C to +150°C**	**D**
***AD22150**	**Monolithic Hall Effect Sensor with Signal Conditioning**	**11**	**−40°C to +150°C**	**D**
***AD22180**	**Battery Monitor Circuit**	**2, 11**	**−55°C to +125°C**	**D**
***AD22181**	**Alternator Control Circuit**	**7**	**−55°C to +125°C**	**D**
***ADXL50**	**Monolithic Accelerometer with Signal Conditioning**	**2, 7**	**−55°C to +125°C**	**D**

Boldface Type: Product recommended for new design.
*New product.
‡Dual Comparators
§For more information, see Complete Analog I/O Ports section.

Audio Products

Voltage Controlled Amplifiers

Model	# of VCAs	THD % typ[1]	Dynamic Range dB typ	Gain Core Class	Package Option	Temp Range[2]	Page	Comments
SSM-2013	1	0.015	106	A	2	C	P	Low Cost, Single
SSM-2014	1	0.02	116	A/AB	2	C	P	Differential Input/Output
*SSM-2018	1	0.007	118	A/AB	2	I	P	Improved SSM-2014
SSM-2120	2	0.012	100	A	2	C	P	Dynamic Range Processor, 2 VCAs & 2 Level Detectors
SSM-2122	2	0.012	100	A	2	C	P	Excellent Price/Performance
SSM-2024	4	0.1	82	A	2	C	P	Low Cost, Current Controlled Amplifier

Other Audio Products

Model[*]	Reference	Page
AD1856	Voltage Output DACs	C I
AD1860	Voltage Output DACs	C I
AD1862	Current Output DACs	C I
AD1864	Multiple DACs	C I
AD1868	Multiple DACs	C I
AD711	High Speed Amplifiers	L
AD712	Dual Amplifiers	L
AD713	Quad Amplifiers	L
AD829	High Speed Amplifiers	L
SSM-2100	Log/Antilog Amplifiers	P
SSM-2110	RMS-to-DC Converters	P
SSM-2131	High Speed Amplifiers	P
SSM-2132	High Speed Amplifiers	P
SSM-2134	Low Noise Amplifiers	P
SSM-2139	Dual Op Amp	P
SSM-2141	Instrumentation Amplifiers	P
*SSM-2142	Instrumentation Amplifiers	P
SSM-2210	Matched Transistors	P
SSM-2220	Matched Transistors	P
SSM-2300	Sample/Track-Hold Amplifiers	P
SSM-2402	Analog Bipolar JFET Switches	C II
SSM-2412	Analog Bipolar JFET Switches	C II

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Analog I/O Ports

Model	DAC/ADC Resolution Bits	DAC/ADC SNR + THD dB	Through-put kSPS	Ref. Volt Int/Ext	Bus Interface	Package Options	Temp Range	Page	Comments
*AD7001	10/8	56/44	2170	2.5 V, Int	10, 8, Serial, µP	10	C[3]	C I	GSM Baseband I/O Port
*AD7002	10/12	–/62	4333 (DAC) 541.7 (ADC)	2.5 V, Int	Serial, µP	10	C[3]	C I	GSM Baseband I/O Port with On-Board GMSK Modulation
*AD7005	10/12	–/62	97.2 (DAC) 194.4 (ADC)	2.3 V, Int	Serial, µP	10	C[3]	C I	TIA Baseband I/O Port
*AD7868	12/12	72/72	83	3.0 V, Int	Serial, µP	2, 3, 6	I, M	C II	Complete 12-Bit Analog I/O System
*AD7869	14/14	78/78	83	3.0 V, Int	Serial, µP	2, 3, 6	I, M	C II	Complete 14-Bit Analog I/O System
*AD28msp02	16/16	65/65	8	2.5 V, Int	Serial, µP	6	C	C I	Complete Voice Band Linear Codec with On-Chip Filtering
*AD28msp01	16/16	80/80	7.2/8.0/9.6	2.5 V, Int	Serial, µP	6	C	C I	Complete Analog Front End for High Performance DSP-Based Modems

Analog Filters

Model	SNR (typ) dB	Bus Interface	Package Options	Temp Range	Page	Comments
AD7341	75	Parallel, µP	2, 5	C	C I	Voiceband Reconstruction Filter
AD7371	75	Parallel, µP	2, 5	C	C I	Voiceband Antialiasing Filter

[1]THD: G = –20 dB, Class A.
[2]Temperature Range: –10°C to +55°C for SSM-2013, SSM-2014, SSM-2120, SSM-2122 and SSM-2024.
[3]Operates to –25°C.
Boldface Type: Product recommended for new design.
*New product.
§For more information, see Complete Analog I/O Ports section.
¶These products are described in Selection Guides appearing in other sections of this Short Form Designers' Guide. Please refer to the section and page indicated for more information on a specific device.

IC MASTER 1992 When contacting suppliers, say you saw it in IC MASTER 3355

Communications Products

Direct Digital Synthesis

Model	Bus Interface	Package Options	Temp Range	Comments	Page
*AD7008	8/16 µP	10	C[1]	DDS IF Modulator with 32-Bit Phase Accumulator and 10-bit DAC, 20 MHz Output Capability, Single 5 V Supply, Low Power	C I
AD9901		3, 4, 5	C, M	Ultrahigh Speed Digital Phase/Frequency Discriminator, No "Dead Zone," Linear Transfer Function up to 200 MHz	C I
*AD9950	8/16 µP	14	C, M	32-Bit, 300 MSPS Phase Accumulator for DDS, On-Board Quad Logic	C I

Telecommunications

Model	Description	Package Options	Temp Range	Page
LIU-01	Serial Data Receiver Reconstructs Clock and Data	2, 3, 6	I	C I
RPT-82	T1/E1 PCM Repeater Featuring Automatic ALBO	3, 6	I	C I
RPT-83	T1/E1 PCM Repeater with ALBO and Clock Shutdown Circuit	3, 6	I	C I
RPT-85	T1/E1 PCM Repeater with XR-T445 Pinout	3, 6	I	C I
RPT-86	T1/E1 Low Power PCM Repeater with ALBO	2, 3, 6	I	C I
RPT-87	T1/E1 Low Power PCM Repeater with ALBO and Clock Shutdown Circuit	2, 3, 6	I	C I

Line Drivers/Receivers

Model	Power Supply Voltage	No. of Drivers	No. of Receivers	External Capacitors	Low Power Shutdown (SD)	TTL Three-State $\overline{EN}$	No. of Pins	Package Options	Temp Range	Page
*AD230	+5 V	5 (232)	0	4	Yes	No	20	2, 3, 6	C, I	C I
*AD231	+5 V & 7.5 V to 13.2 V	2 (232)	2 (232)	2	No	No	14	2, 3, 6	C, I, M	C I
*AD231A	+5 V & 7.5 V to 13.2 V	2 (232)	2 (232)	2	No	No	14	2, 3, 6	C, I, M	C I
*AD232	+5 V	2 (232)	2 (232)	4	No	No	16	2, 3, 6	C, I, M	C I
*AD232A	+5 V	2 (232)	2 (232)	4	No	No	16	2, 3, 6	C, I, M	C I
*AD233	+5 V	2 (232)	2 (232)	None	No	No	20	2	C, I	C I
*AD233A	+5 V	2 (232)	2 (232)	None	No	No	20	2	C, I	C I
*AD234	+5 V	4 (232)	0	4	No	No	16	2, 3, 6	C, I	C I
*AD235	+5 V	5 (232)	5 (232)	None	Yes	Yes	24	2, 3	C, I	C I
*AD236	+5 V	4 (232)	3 (232)	4	Yes	Yes	24	2, 3, 6	C, I, M	C I
*AD237	+5 V	5 (232)	3 (232)	4	No	No	24	2, 3, 6	C, I	C I
*AD238	+5 V	4 (232)	4 (232)	4	No	No	24	2, 3, 6	C, I, M	C I
*AD239	+5 V & 12 V	3 (232)	5 (232)	2	No	Yes	24	2, 3, 6	C, I, M	C I
*AD241	+5 V	4 (232)	5 (232)	4	Yes	Yes	28	6	C, I	C I
*AD7306	+5 V	2 (232) 1 (422)	1 (232) 1 (232/422)	4	No	No	24	6	C, I	C I

[1]Operates to −25°C.
Boldface Type: Product recommended for new design.
*New product.

When contacting suppliers, say you saw it in IC MASTER

Mixed-Signal Application Specific Integrated Circuits

Analog Devices offers a full spectrum of signal conditioning and conversion capabilities in mixed-signal application specific integrated circuits (ASICs). These chip-level systems can implement combined analog/digital designs with 10- to 14-bit accuracy and 12- to 20-bit resolution that formerly required board-level solutions. Combined with our general purpose DSPs from the ADSP-2100 and ADSP-21000 families, our ASICs can provide custom two-chip solutions to meet complex system requirements.

Analog Devices can incorporate most of the functions of its standard monolithic linear and converter parts in full-custom and semicustom ICs. Full-custom parts optimize performance and space requirements, while cell-based semicustom parts reduce development time and engineering expense. Development costs can be cut further by tailoring a predefined system-on-a-chip known as a Linear System Macro to your application.

Analog's experienced design engineers work with powerful computer-aided design tools to design and lay out your circuit. Design centers are currently in Massachusetts, England and Ireland.

Multiple locations for fabrication, assembly and testing ensure a ready supply of production parts. Products can be processed in our MIL-38510 certified facilities.

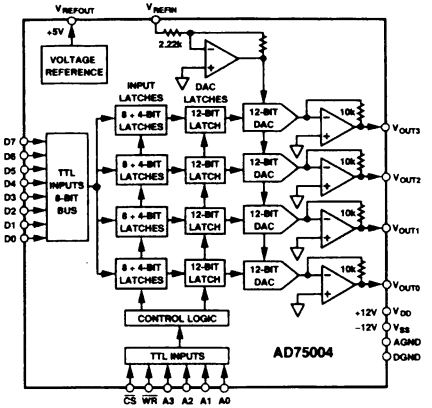
DESIGN EXAMPLES

Analog Devices has created a variety of customer-specific and function-specific ASIC parts. Described here are three Linear System Macros, a custom chipset and a semicustom chip.

AD75004 Quad DAC

This circuit contains four separate 12-bit D/A converters with amplifiers for voltage output and an on-board reference. Double- buffering latches interface with an 8-bit parallel bus and permit updating of all four channels individually or simultaneously. Outputs swing ±5 V, drive ±5 mA, and settle within 4 μs.

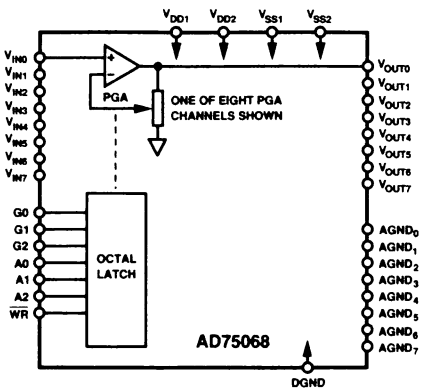
AD75004 QUAD DAC



AD75068 Octal Programmable Gain Amplifier

The AD75068 contains eight programmable gain amplifiers (PGAs). Each is complete, including switch-/resistor network and gain programming latch, and requires no external components. Each channel may be independently programmed for gains from 1 to 128. A unique circuit design maintains constant 2 MHz bandwidth at all gains and offers very low phase shift; the PGAs also feature low input bias current (<4 pA).

AD75068 OCTAL PROGRAMMABLE GAIN AMPLIFIER



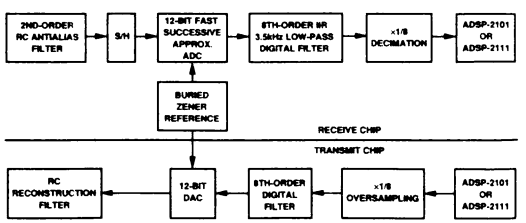
Derivative Circuits

The circuits outlined above can be modified to suit a specific customer's application. For example, the AD75004 quad DAC could be expanded to 6 channels, each of which may have separate reference inputs. The AD75068 could be configured to include filtering. These modifications, when based on standard library cells, can provide the fastest, most cost effective semi-custom solution.

Modem Chipset

Library cells can be combined to form macro building blocks for high speed modems. This two-chip design concept filters and converts data to interface an Analog Devices digital signal processor with the analog circuitry of a 9600-baud modem. On one chip, the received signal passes through an antialiasing filter, sample-and-hold, 12-bit A/D converter, 8th-order digital filter and decimation. On the other chip, transmit data is 8 × oversampled, then goes to an 8th-order filter, a 12-bit DAC and an active reconstruction filter.

HIGH SPEED MODEM CHIPSET

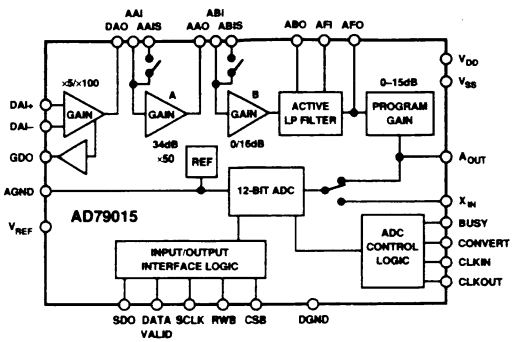


AD79015 Low Level DAS

This circuit is a complete data acquisition system for low level signals (e.g., ECG and EEG) with a throughput of 10,000 samples per second. It provides high accuracy, high stability and functional completeness in a small 28-pin PLCC package. It includes a high performance instrumentation amp, low-pass and band-pass filters, and a 12-bit ADC with on-chip reference. It also includes a fast 8/12-bit serial port to interface to most microprocessor systems.

Mixed-Signal Application Specific Integrated Circuits

AD79015 LOW-LEVEL DAS



HIGH PERFORMANCE PROCESSES

Analog Devices' semicustom and custom circuits are fabricated using the same high performance processes as our standard-product ICs. These mixed bipolar-CMOS processes include thin-film resistors which may be laser trimmed for precise matching and provide stable performance over a wide temperature range.

The ABCMOS, BiMOS II, and Linear Compatible CMOS (LC^2MOS) processes combine bipolar and CMOS devices on one chip. Functional density is an order of magnitude greater than previous mixed-signal processes; over 40,000 devices can be placed on a single chip. Bipolar transistors provide low noise, low offset input stages and moderate power output stages. The CMOS devices offer high input impedance, and make dense logic and analog switches for data converters, multiplexers and switched-capacitor filters. LC^2MOS also provides a JFET for very low noise amplifiers, and a low-noise buried-Zener reference. ABCMOS represents the next generation in a combined bipolar/CMOS process for mixed-signal applications.

The bipolar-CMOS processes operate on supply voltages ranging from single +5 V to split ±15V, with signal levels ranging from single-ended +3 V to ±10 V. These processes are ideally suited for applications in avionics, instrumentation, industrial automation, computers and peripherals, and telecommunications.

ANALOG DEVICES HIGH PERFORMANCE BiCMOS PROCESSES FOR ASICS

Process	Power	Signal	Features
ABCMOS	+5 V to ±5 V	+3 V to ±3 V	Fine Geometries; Double Metal
BiMOS II	±5 V to ±12 V	±3 V to ±10 V	Double Metal
LC^2MOS	+5 V to ±15 V	+3 V to ±10 V	JFET, Zener
LC^2MOS 2	+5 V to ±5 V	+3 V to ±3 V	Fine Geometries; Poly-Poly Capacitors, JFET, Zener

The following table summarizes the processes available for designing ASICs. Other processes in development will offer even higher speed, denser logic and higher integration of analog and digital functions.

CELL LIBRARIES

Cell libraries for the bipolar/CMOS processes are described below. These libraries are growing with the development of new processes, macrocells and cells. Many new catalog parts will also be available as cells. Your local sales office can give you current information on the cell libraries and available Linear System Macros.

Operational amplifiers are available in bipolar, JFET and CMOS configurations. Representative bipolar op amp cells have performance characteristics similar to an AD OP-27 and a slew-enhanced AD741. The LC^2MOS process offers JFET op amps, including an AD711 equivalent.

Instrumentation amplifiers with performance comparable to the AD521 and AD524 are available. Linear comparators have response times down to 100 nanoseconds and strobed comparators have setup/access times down to 50 nanoseconds.

Digital-to-analog converters range in resolution from 8 to 16 bits, and include cells similar to the AD667 and AD1856. Analog-to-digital converters vary from 8 to 16 bits in resolution, and include cells equivalent to the AD7871 and AD674.

Support cells include sample-and-hold amplifiers with performance comparable to the AD585, low-voltage bandgap references comparable to the AD584, and low-noise buried Zener references.

RC active filters and programmable switched-capacitor filters are available with specifications in these ranges:

Topology: all classical filter types
Frequency Range: 200 Hz to 20 kHz (switched-cap) or 100 Hz to 1 MHz (RC)
Number of Sections: up to 10th-order (switched-cap) or 4th-order (RC)
Signal/Noise and THD: >75 dB, compatible with 12-bit data acquisition.

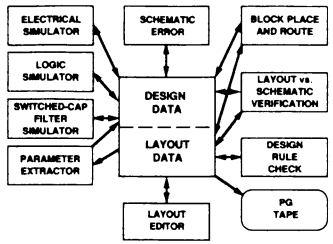
Logic cells include gates, counters, registers, microsequencer, PLA, RAM and ROM. Interface cells include 8-bit and 16-bit parallel I/O ports as well as synchronous serial ports and UARTs.

COMPUTER-AIDED DESIGN TOOLS

Designing a high performance mixed-signal IC is inherently more difficult than designing a gate array. The variety of analog and digital functions requires a cell-based approach. However, the use of powerful tools gives high confidence of functionality at first silicon through thorough simulation and layout verification. Complete computer-generated documentation of all schematics and analog and logic simulation waveforms permits thorough evaluation of Analog's design by your design staff before signoff for final layout and fabrication.

The overall work flow through the CAD environment follows. Key to meeting the special challenges of mixed analog/digital circuitry are the simulation and auto-layout tools, and the unification of design and layout information in a single database. Analog Devices has developed a suite of proprietary computer-aided design tools, called JANUS™, to address these issues and to implement turn-key designs.

COMPUTER-AIDED DESIGN FLOW



The JANUS schematic editor offers numerous time-saving techniques and provides for specification of such data as wire widths, routing layers and routing priorities. It automatically generates a net list used by subsequent tools.

Analog uses several simulators, including electrical, logic and behavioral types. ADICE, a proprietary enhanced version of the SPICE electrical simulator, gives precision simulation of critical analog sections. It uses Newton-Raphson methods to iteratively solve nonlinear time-dependent simultaneous differential equations. It is efficient for circuits up to about 250 active devices and is used for the frequency domain or transient analysis of analog cells such as op amps, or sensitive digital cells such as dynamic RAM.

Event-driven simulators handle larger circuits, with thousands of devices, and are typically used to simulate logic. The JANUS mixed-signal simulator combines an event-driven simulator with Newton-Raphson methods. It dynamically partitions the circuit to apply the faster event-driven techniques where possible, and the matrix methods where necessary. It also dynamically sizes the matrix and time steps to speed simulation further. The simulator can operate at the transistor level or use behavioral models, or both at the same time, allowing trade-offs between accuracy and speed.

For layout, the challenge is to increase automation while accommodating the layout sensitivity of analog circuitry. Device generators exist for the full range of active and passive devices available in the technology to automatically create a physical representation of the circuit schematic. This layout may be optimized through conventional interactive polygon-pushing.

The JANUS routing editor is driven by the connectivity of the schematics, but allows great freedom to manually control the routing of critical analog signal paths or power/ground lines while autorouting noncritical nets and spacing the layout to achieve automatic enforcement of layout rules. The JANUS routing editor uses up to three interconnect levels, and will automatically expand and compact placement as necessary to achieve 100% routing.

Finally, industry-standard layout verification tools assure conformance of the layout to both the schematic and design rules to give high confidence of functionality in first silicon. The CAD tool suite communicates via industry-standard stream formats to external databases and pattern generators.

TEST AND TRIM

Analog Devices has over 20 years of experience in testing complex circuits and manufactures commercial test systems for precision linear ICs. In each fabrication facility, a computer network integrates Analog Devices, H-P, Teradyne and LTX test equipment. The design, wafer probe and test areas share data on the network for statistical analysis and device modeling.

All Analog Devices ASICs are tested at the wafer level, and most are laser-wafer trimmed to achieve high accuracy. Untrimmed thin-film resistors match within 1% to 0.1%, depending on area. Trimmed resistors can match to better than 0.01%. Wafers may be laser drift trimmed with a hot-chuck probe to minimize the effects of temperature on accuracy.

After packaging, all parts are tested to assure that they meet guaranteed specifications. Environmental handlers can verify parts at multiple temperatures. Burn-in is performed as specified by the customer.

PACKAGING

Analog Devices ICs are available in most modern package types, including high pin-count and surface mount varieties. ASICs may be assembled in any of Analog Devices' standard packages, listed below. This list is constantly expanded and other packages may be used if they are suitable for high performance applications.

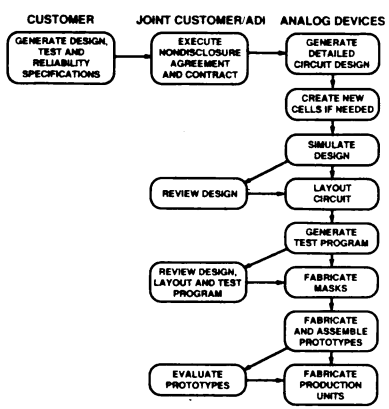
Available Packages
Pin Grid Array (PGA): 68 to 144 pins
Leaded Ceramic Chip Carrier (LDCC): 44 pins
Plastic Quad Flat Pack (PQFP): 44 to 132 pins
Plastic Leaded Chip Carrier (PLCC): 20 to 68 pins
Plastic Dual Inline Package (DIP): 14 to 64 pins
Side-Brazed DIP: 14 to 64 pins
Frit-Seal DIP (Cerdip): 14 to 40 pins
Small Outline (SO): 14 to 28 pins
Ceramic Quad Flat Pack (CQFP): 80 to 104 leads

PROGRAM RESPONSIBILITIES AND INTERFACES

The following figure shows the major phases in developing an ASIC and responsibilities during each phase. The overall development time depends on the complexity of the circuit and on how custom the design is.

Your Analog Devices Sales Engineer is your first interface for ASIC development. Your local sales office can provide further information on Analog Devices' custom/semicustom capabilities.

PROGRAM RESPONSIBILITIES AND INTERFACES



JANUS is a trademark of Analog Devices, Inc.

Power Supplies

Modular AC/DC Power Supplies

GENERAL DESCRIPTION

Analog Devices offers a broad line of modular ac/dc power supplies that provide both OEMs and designers a reliable, easy to use, low-cost solution to their power requirements. Models are available in PC mountable and chassis mountable designs with 5 volt to 15 volt (single, dual, triple) outputs and current ratings from 25 mA to 5 amps. Since these modular supplies are fully encapsulated, no trimming or external component selection is necessary; simply mount the unit, connect power and output leads, and you're on the air! Most Analog Devices' power supplies are available from stock in both large and small quantities with substantial discounts being applied to large quantity orders.

SPECIFICATIONS – Typical @ +25°C and 115 V ac 60 Hz unless otherwise noted*

	Type	Model	Output Voltage Volts	Output Current mA	Line Reg. max %	Load Reg. max %	Output Voltage Error max	Ripple & Noise mV rms max	Dimensions Inches
PC Board Mounted	Dual Output	904	±15	±50	0.02	0.02	±200 mV −0 mV	0.5	3.5×2.5×0.875
		902	±15	±100	0.02	0.02	+300 mV −0 mV	0.5	3.5×2.5×1.25
		902-2	±15	±100	0.02	0.02	+300 mV −0 mV	0.5	3.5×2.5×0.875
		920	±15	±200	0.02	0.02	+300 mV −0 mV	0.5	3.5×2.5×1.25
		925	±15	±350	0.02	0.02	±1%	0.5	3.5×2.5×1.62
		921	±12	±240	0.02	0.02	+300 mV −0 mV	0.5	3.5×2.5×1.25
	Single Output	905	5	1000	0.02	0.05	±1%	1	3.5×2.5×1.25
		922	5	2000	0.02	0.05	±1%	1	3.5×2.5×1.62
		928	5	3000	0.05	0.10	±2%	5 (typ)	3.5×2.5×1.25
	Triple Output	923	±15	±100	0.02	0.02	±1%	0.5	3.5×2.5×1.25
			+5	500	0.02	0.05	±1%	0.5	
		927	±15	±150	0.02	0.02	±2%	0.5 (typ)	3.5×2.5×1.62
			+5	1000	0.02	0.10	±2%	1.0 (typ)	
Chassis Mounted	Dual Output	952	±15	±100	0.05	0.05	±2%	1	4.4×2.7×1.45
		970	±15	±200	0.05	0.05	±2%	1	4.4×2.7×1.45
		973	±15	±350	0.05	0.05	±2%	1	4.4×2.7×2.00
		975	±15	±500	0.05	0.05	±2%	1	4.4×2.7×2.00
	Single Output	955	5	1000	0.05	0.15	±2%	2	4.4×2.7×1.45
		976	5	3000	0.05	0.10	±2%	5 (typ)	4.75×2.7×1.45
		977	5	5000	0.05	0.10	±2%	5 (typ)	4.75×2.7×1.45
	Triple Output	974	±15	±150	0.02	0.02	±2%	0.5 (typ)	4.75×2.7×1.45
			+5	1000	0.02	0.10	±2%	1.0 (typ)	

*Consult Analog Devices Power Supplies Catalog for additional information.
Specifications subject to change without notice.

AC/DC POWER SUPPLY FEATURES

- Current Limit Short Circuit Protection
- PC Mounted and Chassis Mounted Versions
- Single (+5 V), Dual (±12 V, ±15 V), and Triple (±15 V/+5 V, ±15 V/+1 V to +15 V) Output Supplies
- Current Outputs:
  25 mA to 1000 mA for Dual and Triple Output Supplies
  250 mA to 5000 mA for Single Output Supplies
- Wide Input Voltage Range
- Low Output Ripple and Noise
- Excellent Line & Load Regulation Characteristics
- High Temperature Stability
- Free-Air Convection Cooling; No External Heat Sink Required

GENERAL SPECIFICATIONS

Power Requirements

Input Voltage Range:	105 V ac to 125 V ac
Frequency:	50 Hz to 250 Hz

Electrical Specifications

Temperature Coefficient:	0.02%/°C
Output Voltage Accuracy:	±2%, max See Specifications Table
Breakdown Voltage:	500 V rms, min
Isolation Resistance:	50 MΩ
Short Circuit Protection:	All ac/dc power supplies employ current limiting. They can withstand substantial overload including direct short. Prolonged operation should be avoided since excessive temperature rises will occur.

Environmental Requirements

Operating Temperature Range:	−25°C to +71°C
Storage Temperature Range:	−25°C to +85°C

When contacting suppliers, say you saw it in IC MASTER

Modular DC/DC Converters

GENERAL DESCRIPTION

Analog Devices' line of compact dc/dc converters offers system designers a means of supplying a reliable, easy to use, low cost solution to a variety of floating (analog and digital) power applications. These devices provide high accuracy, short circuit protected, regulated outputs with very low output noise and ripple characteristics.

Fourteen models are offered in five power levels of 1 watt, 1.8 watts, 4.5 watts, 6 watts and 12 watts. Input voltage versions include 5 volt, 12 volt, 24 volt and 28 volt with output ranges as follows: +5 volt, ±12 volts and ±15 volts at ±60 mA to 1000 mA output current capability.

Most models are high efficiency (typically over 60% at full load) and feature complete 6-sided continuous shielding for EMI/RFI protection. A π-type input filter is contained, in some models, which virtually eliminates the effects of reflected input ripple current. Most Analog Devices' dc/dc converters are available from stock in both large and small quantities with substantial discounts being applied to large quantity orders.

DC/DC POWER SUPPLY FEATURES

- Inaudible (>20 kHz) Converter Switching Frequency
- Continuous, Six-Sided EMI/RFI Shielding Except on 1 Watt and 1.8 Watt Models
- Output Short Circuit Protection (Either Output to Common)
- Automatic Restart After Short Condition Removed
- Automatic Starting with Reverse Current Injected into Outputs
- Low Output Ripple and Noise
- High Temperature Stability
- Free Air Convection Cooling
  No external heat sink or specification derating is required over the operating temperature range.

GENERAL SPECIFICATIONS FOR 1 W AND 1.8 W MODELS

Line Regulation – Full Range: ±0.3% (±1% max, 949)
Load Regulation – No Load to Full Load: ±0.4% (±0.5% max, 949)
Output Noise and Ripple: 20 mV p–p, with 15 μF tantalum capacitor across each output (2 mV rms max, 949)
Breakdown Voltage: 300 V dc min (500 V dc min, 949)
Input Filter Type: π
Operating Temperature Range: −25°C to +71°C
Storage Temperature Range: −40°C to +125°C (+100°C, 949)
Fusing: If input fusing is desired, we recommend the use of a slow blow type fuse that is rated at 150%–200% of the dc/dc converter's full load input current.

GENERAL SPECIFICATIONS FOR 4.5 W, 6 W AND 12 W MODELS

Line Regulation – Full Range: ±0.07% max (±0.02% max, 951, 960 Series) (±0.1% max, 943)
Load Regulation – No Load to Full Load: ±0.07% max (±0.02% max, 951, 960 Series) (±0.1% max, 943)
Output Noise and Ripple: 1 mV rms max
Breakdown Voltage: 500 V dc min
Input Filter Type: π
Operating Temperature Range: −25°C to +71°C
Storage Temperature Range: −40°C to +125°C
Fusing: If input fusing is desired, we recommend the use of a slow blow type fuse that is rated at 150%–200% of the dc/dc converter's full load input current.

SPECIFICATIONS – Typical @ +25°C at nominal input voltage unless otherwise noted*

Model	Output Voltage Volts	Output Current mA	Input Voltage Volts	Input[1] Voltage Range Volts	Input Current Full Load	Output Voltage Error max	Temperature Coefficient /°C max	Efficiency Full Load min	Dimensions Inches
943	5	1000	5	4.75/5.25	1.52A	±1%	±0.02%	62%	2.0×2.0×0.38
958	5	100	5	4.5/5.5	200 mA	±5%	±0.01% (typ)	50%	1.25×0.8×0.4
941	±12	±150	5	4.75/5.25	1.17A	±1%	±0.01%	58%	2.0×2.0×0.38
960	±12	±40	5	4.5/5.5	384 mA	±5%	±0.01% (typ)	50%	1.25×0.8×0.4
962	±15	±33	5	4.5/5.5	396 mA	±5%	±0.01% (typ)	50%	1.25×0.8×0.4
964	±15	±33	12	10.8/13.2	165 mA	±5%	±0.01% (typ)	50%	1.25×0.8×0.4
965	±15	±190	5	4.65/5.5	1.7 A	±1%	±0.005% (typ)	62% (typ)	2.0×2.0×0.38
966	±15	±190	12	11.2/13.2	710 mA	±1%	±0.005% (typ)	62% (typ)	2.0×2.0×0.38
967	±15	±190	24	22.3/26.4	350 mA	±1%	±0.005% (typ)	62% (typ)	2.0×2.0×0.38
949	±15	±60**	5	4.65/5.5	0.6 A	±2%	±0.03%	58%	2.0×1.0×0.375
940	±15	±150	5	4.75/5.25	1.35 A	±1%	±0.01%	62%	2.0×2.0×0.38
953	±15	±150	12	11/13	0.6 A	±0.5%	±0.01%	62%	2.0×2.0×0.38
945	±15	±150	28	23/31	250 mA	±0.5%	±0.01%	61%	2.0×2.0×0.38
951	±15	±410	5	4.65/5.5	3.7 A	±0.5%	±0.01%	62%	3.5×2.5×0.88

NOTES
[1]Models 940 and 941 will deliver up to 120 mA output current (and Model 943 will deliver up to 600 mA) over an input voltage range of 4.65 V dc and 5.5 V dc.
*Consult Analog Devices Power Supplies Catalog for additional information.
**Single-ended or unbalanced operation is permissible such that total output current load does not exceed a total of 120 mA.
Specifications subject to change without notice.

Products Available to Standard Military Drawings

Analog Devices' IC and hybrid products are supplied with processing to the three major levels of military screening, JAN QPL, Standard Military Drawing (SMD) and MIL-STD-883B (Revision C). These products are all produced in facilities which are fully qualified to MIL-M-38510 for integrated circuits, or MIL-STD-1772 for hybrids. In addition to these listings, we also publish a *Military Products Databook* which contains the specification details for designers who specify components for military contracts. The listings here are up-to-date and accurate as of the publication date (10/90), but there is ongoing development in this area by ADI and military procurement agencies. For status of specific parts, please contact your local salesperson. This list will also be updated and published every six months in *Analog Briefings* and in this *Short Form Designers' Guide*.

SMD Part Number	Generic Part Number	Description
5962-8965501LX	AD7672TQ10/883B	12-Bit High Speed ADC
5962-8965502LX	AD7672UQ10/883B	12-Bit High Speed ADC
5962-8965503LX	AD7672TQ05/883B	12-Bit High Speed ADC
5962-8965504LX	AD7672UQ05/883B	12-Bit High Speed ADC
5962-8512701XA	AD574AUD/883B	Complete 12-Bit ADC
5962-8512702XA	AD574ATD/883B	Complete 12-Bit ADC
5962-8759101LX	AD7572SQ12/883B	Complete 12-Bit 12 µs ADC
5962-87591013X	AD7572SE12/883B	Complete 12-Bit 12 µs ADC
5962-8759102LX	AD7572TQ12/883B	Complete 12-Bit 12 µs ADC
5962-87591023X	AD7572TE12/883B	Complete 12-Bit 12 µs ADC
5962-8759103LX	AD7572UQ12/883B	Complete 12-Bit 12 µs ADC
5962-87591033X	AD7572UE12/883B	Complete 12-Bit 12 µs ADC
5962-9063201RX	AD7870SQ/883B	12-Bit 100 kHz Sampling ADC
5962-9063202RX	AD7870TQ/883B	12-Bit Sampling ADC
5962-8759104LX	AD7572SQ05/883B	Complete 12-Bit 5 µs ADC
5962-87591043X	AD7572SE05/883B	Complete 12-Bit 5 µs ADC
5962-8759105LX	AD7572TQ05/883B	Complete 12-Bit 5 µs ADC
5962-87591053X	AD7572TE05/883B	Complete 12-Bit 5 µs ADC
5962-8759106LX	AD7572UQ05/883B	Complete 12-Bit 5 µs ADC
5962-87591063X	AD7572UE05/883B	Complete 12-Bit 5 µs ADC
5962-8861501XA	AD674AUD/883B	Complete 12-Bit ADC
5962-8861502XA	AD674ATD/883B	Complete 12-Bit ADC
5962-8969801	AD7579SQ/883B	10-Bit Sampling ADC with (8 + 2) Loading
5962-8969802	AD7580SQ/883B	10-Bit Sampling ADC
5962-8865801XC	AD578SD/883B	Complete 12-Bit ADC
5962-8865802XC	AD578TD/883B	Complete 12-Bit ADC
5962-8865803XC	AD578SZ/883B	Complete 12-Bit ADC
5962-8865804XC	AD578TZ/883B	Complete 12-Bit ADC
5962-8850501RA	AD573SD/883B	10-Bit ADC
5962-8680202VA	AD571SD/883B	Complete 10-Bit ADC
5962-8680201VA	AD570SD/883B	Complete 8-Bit ADC
5962-8961601VX	ADC-908AX/MD	CMOS Fast 8-Bit A/D Converter
5962-89616022X	ADC-908BRC/MD	CMOS Fast 8-Bit A/D Converter
5962-8961602VX	ADC-908BX/MD	CMOS Fast 8-Bit A/D Converter
5962-8961601YX	AD7574SQ/883B	8-Bit ADC
5962-8961602YX	AD7574TQ/883B	8-Bit ADC
5962-8961603VX	PM-7574AX/MD	CMOS 8-Bit A/D
5962-89616042X	PM-7574BRC/MD	CMOS 8-Bit A/D
5962-8961604VX	PM-7574BX/MD	CMOS 8-Bit A/D
5962-8776201VX	AD7575SQ/883B	8-Bit ADC with T/H
5962-8776202VX	AD7575TQ/883B	8-Bit ADC with T/H
5962-87762012X	AD7575SE/883B	8-Bit ADC with T/H
5962-87762022X	AD7575TE/883B	8-Bit ADC with T/H
5962-8763501RA	AD670SD/883B	Signal Conditioning 8-Bit ADC
5962-8850502RA	AD673SD/883B	8-Bit ADC
5962-89518012X	AD7821TE/883B	8-Bit, 600 ns ADC with T/H
5962-8951801RX	AD7821TQ/883B	8-Bit, 600 ns ADC with T/H
5962-8865001RX	AD7820TQ/883B	8-Bit 2 µs ADC with T/H
5962-88650012X	AD7820TE/883B	8-Bit 2 µs ADC with T/H
5962-8865002RX	AD7820UQ/883B	8-Bit 2 µs ADC with T/H
5962-88650022X	AD7820UE/883B	8-Bit 2 µs ADC with T/H
5962-8876401LX	AD7824TQ/883B	4-Channel 8-Bit ADC
5962-8876402LX	AD7824UQ/883B	4-Channel 8-Bit ADC
5962-8876403XX	AD7828TQ/883B	8-Channel 8-Bit ADC
5962-8876404	AD7828UE/883B	8-Channel 8-Bit ADC
5962-8876404XX	AD7828UQ/883B	8-Channel 8-Bit ADC
5962-8962901LX	AD7569SQ/883B	Complete 8-Bit Analog I/O Sys
5962-8962902LX	AD7569TQ/883B	Complete 8-Bit Analog I/O Sys
8300201JX	AD DAC87/883B	12-Bit Hybrid DAC
8300301JA	AD DAC87/883B	12-Bit Monolithic DAC
5962-8967101LX	DAC-8221AW	Dual 12-Bit Buffered Multiplying CMOS D/A

When contacting suppliers, say you saw it in IC MASTER

SMD Part Number	Generic Part Number	Description
5962-89671023X	DAC-8221BTC	Dual 12-Bit Buffered Multiplying CMOS D/A
5962-8967201LX	DAC-8222AW/MD	Dual 12-Bit Double-Buffered Multiplying CMOS D/A
5962-8965701LX	AD7547SQ/883B	12-Bit Dual Multiplying DAC
5962-8965702LX	AD7547TQ/883B	12-Bit Dual Multiplying DAC
5962-8965703LX	AD7547UQ/883B	12-Bit Dual Multiplying DAC
5962-8776301LX	AD7537SQ/883B	12-Bit Dual Multiplying DAC
5962-87763013X	AD7537SE/883B	12-Bit Dual Multiplying DAC
5962-8776302LX	AD7537TQ/883B	12-Bit Dual Multiplying DAC
5962-87763023X	AD7537TE/883B	12-Bit Dual Multiplying DAC
5962-8776303LX	AD7537UQ/883B	12-Bit Dual Multiplying DAC
5962-87763033X	AD7537UE/883B	12-Bit Dual Multiplying DAC
5962-8876501RX	AD7549SQ/883B	12-Bit Dual DAC
5962-8876502RX	AD7549TQ/883B	12-Bit Dual DAC
5962-8876601LX	AD7245SQ/883B	12-Bit DACPORT
5962-8876602RX	AD7248SQ/883B	12-Bit DACPORT
5962-89697013X	AD7846SE/883B	16-Bit V_{OUT} Multiplying DAC
5962-8969701XX	AD7846SQ/883B	16-Bit V_{OUT} Multiplying DAC
5962-8876701LX	AD7845SQ/883B	12-Bit V_{OUT} Multiplying DAC
5962-8948104VX	PM-7541AAX/MD	CMOS 12-Bit Monolithic Multiplying CMOS D/A
5962-8948103VX	PM-7541ABX/MD	CMOS 12-Bit Monolithic Multiplying CMOS D/A
5962-89481032X	PM-7541ABRC/MD	CMOS 12-Bit Monolithic Multiplying CMOS D/A
5962-89481012X	AD7541ASE/883B	12-Bit Multiplying DAC
5962-8948101VX	AD7541ASQ/883B	12-Bit Multiplying DAC
5962-89481022X	AD7541ATE/883B	12-Bit Multiplying DAC
5962-8948102VX	AD7541ATQ/883B	12-Bit Multiplying DAC
5962-8770201RX	AD7545SQ/883B	12-Bit Multiplying DAC
5962-8770202RX	AD7545TQ/883B	12-Bit Multiplying DAC
5962-8770203RX	AD7545UQ/883B	12-Bit Multiplying DAC
5962-8770204RX	AD7545GUQ/883B	12-Bit Multiplying DAC
5962-87702012X	AD7545SE/883B	12-Bit Multiplying DAC
5962-87702022X	AD7545TE/883B	12-Bit Multiplying DAC
5962-87702032X	AD7545UE/883B	12-Bit Multiplying DAC
5962-87702042X	AD7545GUE/883B	12-Bit Multiplying DAC
5962-8770206RX	PM-7545AR/MD	12-Bit Buffered Multiplying CMOS D/A
5962-87702062X	PM-7545ARC/MD	12-Bit Buffered Multiplying CMOS D/A
5962-8770205RX	PM-7545BR/MD	12-Bit Buffered Multiplying CMOS D/A
5962-87702052X	PM-7545BRC/MD	12-Bit Buffered Multiplying CMOS D/A
5962-8877801RX	PM-7645AR/MD	12-Bit Buffered Multiplying CMOS D/A
5962-88778012X	PM-7645ARC/MD	12-Bit Buffered Multiplying CMOS D/A
5962-8877802RX	PM-7645BR/MD	12-Bit Buffered Multiplying CMOS D/A
5962-88778022X	PM-7645BRC/MD	12-Bit Buffered Multiplying CMOS D/A
5962-8780101XA	AD567SD/883B	12-Bit High Speed DAC
5962-8865901A	AD667SD/883B	12-Bit Dual Buffered DAC
5962-8850901X	AD390SD/883B	12-Bit Quad DAC
5962-8850902X	AD390TD/883B	12-Bit Quad DAC
5962-8851001X	AD394SD/883B	12-Bit Quad DAC
5962-8851002X	AD394TD/883B	12-Bit Quad DAC
5962-8851003X	AD395SD/883B	12-Bit Quad DAC
5962-8851004X	AD395TD/883B	12-Bit Quad DAC
5962-89932012X	DAC-08RC/MD	8-Bit High Speed Multiplying D/A Converter
5962-8770001EX	AD7524SQ/883B	8-Bit DAC
5962-8770002EX	AD7524TQ/883B	8-Bit DAC
5962-8770003EX	AD7524UQ/883B	8-Bit DAC
5962-87700012X	AD7524SE/883B	8-Bit DAC
5962-87700022X	AD7524TE/883B	8-Bit DAC
5962-87700032X	AD7524UE/883B	8-Bit DAC
5962-89471012X	AD7111TE/883B	CMOS Logarithmic DAC
5962-8947101EX	AD7111TD/883B	CMOS Logarithmic DAC
5962-89471022X	AD7111UE/883B	CMOS Logarithmic DAC
5962-8947102EX	AD7111UD/883B	CMOS Logarithmic DAC
5962-8770003EX	PM-7524AQ/MD	CMOS 8-Bit Buffered Multiplying D/A
5962-87700032X	PM-7524ARC/MD	CMOS 8-Bit Buffered Multiplying D/A
5962-87700022X	PM-7524BRC/MD	CMOS 8-Bit Buffered Multiplying D/A

Products Available to Standard Military Drawings

SMD Part Number	Generic Part Number	Description
5962-8770002EX	PM-7524BQ/MD	CMOS 8-Bit Buffered Multiplying D/A
5962-8770101RX	AD7528SQ/883B	8-Bit Dual Buffered DAC
5962-87701012X	AD7528SE/883B	8-Bit Dual Buffered DAC
5962-8770102RX	AD7528TQ/883B	8-Bit Dual Buffered DAC
5962-87701022X	AD7528TE/883B	8-Bit Dual Buffered DAC
5962-8770103RX	AD7528UQ/883B	8-Bit Dual Buffered DAC
5962-87701032X	AD7528UE/883B	8-Bit Dual Buffered DAC
5962-8770103RX	PM-7528AR/MD	Dual 8-Bit Buffered Multiplying CMOS D/A
5962-87701032X	PM-7528ARC/MD	Dual 8-Bit Buffered Multiplying CMOS D/A
5962-8770102RX	PM-7528BR/MD	Dual 8-Bit Buffered Multiplying CMOS D/A
5962-87701022X	PM-7528BRC/MD	Dual 8-Bit Buffered Multiplying CMOS D/A
5962-8778901EA	AD558SD/883B	8-Bit DACPORT
5962-8778902EA	AD558TD/883B	8-Bit DACPORT
5962-86678010X	DAC-8408AT/MD	Quad 8-Bit Multiplying CMOS D/A with Memory
5962-86678020X	DAC-8408BT/MD	Quad 8-Bit Multiplying CMOS D/A with Memory
5962-8780201RX	AD7226TQ/883B	8-Bit Quad DAC with Amps
5962-87802012X	AD7226TE/883B	8-Bit Quad DAC with Amps
5962-8866301LX	AD7228TQ/883B	8-Bit Octal Voltage Out DAC
5962-88663013X	AD7228TE/883B	8-Bit Octal Voltage Out DAC
5962-8866302LX	AD7228UQ/883B	8-Bit Octal Voltage Out DAC
5962-88663023X	AD7228UE/883B	8-Bit Octal Voltage out DAC
5962-8503001YX	AD2700SD/883B	Precision +10 V Reference
5962-8503002YX	AD2700UD/883B	Precision +10 V Reference
5962-850305YX	AD2701SD/883B	Precision −10 V Reference
5962-850306YX	AD2701TD/883B	Precision −10 V Reference
5962-8503003YX	AD2702SD/883B	Precision ±10 V Reference
5962-8503004YX	AD2702UD/883B	Precision ±10 V Reference
5962-8958101GX	REF-01AJ/MD	+10 V Precision Voltage Reference
5962-89581012X	REF-01ARC/MD	+10 V Precision Voltage Reference
5962-8958101PX	REF-01AZ/MD	+10 V Precision Voltage Reference
5962-8958102GX	REF-01J/MD	+10 V Precision Voltage Reference
5962-89581022X	REF-01RC/MD	+10 V Precision Voltage Reference
5962-8958102PX	REF-01Z/MD	+10 V Precision Voltage Reference
5962-8551401GX	REF-02AJ/MD	+5 V Precision Voltage Reference/ Temp Transducer
5962-85514012X	REF-02ARC/MD	+5 V Precision Voltage Reference/ Temp Transducer
5962-8551401PX	REF-02AZ/MD	+5 V Precision Voltage Reference/ Temp Transducer
5962-8947901GX	REF-10AJ/MD	+10 V Precision Voltage Reference (Longterm Stability)
5962-8947902GX	REF-10BJ/MD	+10 V Precision Voltage Reference (Longterm Stability)
5962-8686101XC	AD580SH/883B	Precision +2.5 V Reference
5962-8686102XC	AD580TH/883B	Precision +2.5 V Reference
5962-8757101XC	AD590JF/883B	Temp. Transducer 1 μA/K
5962-8757101YC	AD590JH/883B	Temp. Transducer 1 μA/K
5962-8757102XC	AD590KF/883B	Temp. Transducer 1 μA/K
5962-8757102YC	AD590KH/883B	Temp. Transducer 1 μA/K
5962-8757103XC	AD590LF/883B	Temp. Transducer 1 μA/K
5962-8757103YC	AD590LH/883B	Temp. Transducer 1 μA/K
5962-8757104XC	AD590MF/883B	Temp. Transducer 1 μA/K
5962-8757104YC	AD590MH/883B	Temp. Transducer 1 μA/K
5962-8987101GX	CMP-01J/MD	Fast Precision Comparator
5962-8987101PX	CMP-01Z/MD	Fast Precision Comparator
5962-8990403CX	CMP-04BY/MD	Quad Low Power Precision Comparator
5962-8990401CX	CMP-404AY/MD	Quad Low Power Precision Comparator
5962-8990402CX	CMP-404BY/MD	Quad Low Power Precision Comparator
5962-7801903EA	AD96687TQ/883B	Voltage Comparator
5962-78019032A	AD96687TE/883B	Voltage Comparator
5962-8600804EA	AD96685TQ/883B	Voltage Comparator
5962-86008042A	AD96685TE/883B	Voltage Comparator
5962-8600804IA	AD96685TH/883B	Voltage Comparator
5962-86877012X	PM-111RC/MD	Precision Voltage Comparator
5962-8601401CX	PM-119Y/MD	Precision High Speed Dual Comparator

SMD Part Number	Generic Part Number	Description
5962-86014012X	PM-119RC/MD	Precision, High Speed, Dual Comparator
5962-87739012X	PM-139ARC/MD	Quad Low Power Voltage Comparator
5962-8773901CX	PM-139AY-MD	Quad Low Power Voltage Comparator
5962-77008012X	PM-139RC/MD	Quad Low Power Voltage Comparator
5962-7700801CX	PM-139Y/MD	Quad Low Power Voltage Comparator
5962-8780201RX	PM-7226AR/MD	Quad 8-Bit CMOS D/A with Voltage Output
5962-8754001CA	AD585SQ/883B	High Speed S/H Amp
5962-8954103CX	SMP-10AY/MD	Low Droop Rate Sample-and-Hold Amp
5962-8954104CX	SMP-10BY/MD	Low Droop Rate Sample-and-Hold Amp
5962-89541042X	SMP-10BRC/MD	Low Droop Rate Sample-and-Hold Amp
5962-8954101CX	SMP-11AY/MD	Accurate Sample-and-Hold Amp
5962-89541022X	SMP-11BRC/MD	Accurate Sample-and-Hold Amp
5962-8954102CX	SMP-11BY/MD	Accurate Sample-and-Hold Amp
5962-87719	AD625/883B	Instrumentation Amp
5962-88539	AD524/883B	Instrumentation Amp
5962-8863001VX	AMP-01AX/MD	Low Noise, Precision Instrumentation Amp
5962-88630023X	AMP-01BTC/MD	Low Noise, Precision Instrumentation Amp
5962-8863002VX	AMP-01BX/MD	Low Noise, Precision Instrumentation Amp
5962-8857901XC	HOS-050A/883B	Video Op Amp
5962-8857902XC	HOS-060SH/883B	Video Op Amp
5962-8873301XC	ADSP-1010BTD/883B	Digital Signal Multiplier
5962-8873302XC	ADSP-1010BSD/883B	Digital Signal Multiplier
5962-8873303XC	ADSP-1010BSD/883B	75 ns Digital Signal Multiplier
5962-8873301ZC	ADSP-1010BTG/883B	Digital Signal Multiplier
5962-8873302ZC	ADSP-1010BSG/883B	Digital Signal Multiplier
5962-8873303ZC	ADSP-1010BSG/883B	75 ns Digital Signal Multiplier
5962-8971001XX	ADG526ATQ/883B	16-Channel Latched Multiplexer
5962-8971003XX	ADG526ATE/883B	16-Channel Latched Multiplexer
5962-8771701XX	MUX-16AT/MD	16-Channel JFET Analog Multiplexer
5962-8771702XX	MUX-16BT/MD	16-Channel JFET Analog Multiplexer
5962-87717023X	MUX-16BTC/MD	16-Channel JFET Analog Multiplexer
5962-8771601EX	MUX-08AQ/MD	8-Channel JFET Analog Multiplexers
5962-8771602EX	MUX-08BQ/MD	8-Channel JFET Analog Multiplexers
5962-87716022X	MUX-08BRC/MD	8-Channel JFET Analog Multiplexers
7705201EX	ADG508ATQ/883B	8-Channel Analog Mux
5962-8768901VX	ADG528ATQ/883B	8-Channel Latched Mux
5962-90635	ADG528ATE/883B	8-Channel Latched Multiplexer
77052012X	ADG508ATE/883B	8-Channel Analog Mux
5962-8771801EX	MUX-24AQ/MD	Dual 4-Channel JFET Analog Multiplexer
5962-8771802EX	MUX-24BQ/MD	Dual 4-Channel JFET Analog Multiplexer
5962-89710023X	ADG527ATE/883B	Dual 8-Channel Latched Multiplexer
5962-8971002XX	ADG527ATQ/883B	Dual 8-Channel Latched Multiplexer
7705201EX	ADG508ATQ/883B	8-Channel Analog Multiplexer
5962-8671601EX	ADG201HSTQ/883B	Quad SPST Fast Switch
5962-86716012X	ADG201HSTE/883B	Quad SPST Fast Switch
77053022X	ADG201ATE/883B	Quad SPST Analog Switch
7705302EX	ADG201ATQ/883B	Quad SPST Analog Switch
5962-8966901EX	SW-06BQ/MD	Quad SPST JFET Analog Switch
5962-89669012X	SW-06BRC/MD	Quad SPST JFET Analog Switch
5962-8773501XC	ADSP-2100SG/883B	6 MHz Digital Signal µP
5962-8773503XC	ADSP-2100ASG/883B	8 MHz Digital Signal µP
5962-8773504XC	ADSP-2100ATG/883B	10 MHz Digital Signal µP
5962-8203601GX	OP-07AJ/MD	Ultralow Offset Voltage Op Amp
5962-82036012X	OP-07ARC/MD	Ultralow Offset Voltage Op Amp
5962-8203601PX	OP-07AZ/MD	Ultralow Offset Voltage Op Amp
5962-8203602GX	OP-07J/MD	Ultralow Offset Voltage Op Amp
5962-82036022X	OP-07RC/MD	Ultralow Offset Voltage Op Amp
5962-8203602PX	OP-07Z/MD	Ultralow Offset Voltage Op Amp
5962-89801012X	OP-11ARC/MD	Quad Matched 741-Type Op Amp
5962-8980101CX	OP-11AY/MD	Quad Matched 741-Type Op Amp
5962-89801022X	OP-11BRC/MD	Quad Matched 741-Type Op Amp
5962-8980102CX	OP-11BY/MD	Quad Matched 741-Type Op Amp
5962-8771401GX	OP-14AJ/MD	Dual Matched High Performance Op Amp

Products Available to Standard Military Drawings

SMD Part Number	Generic Part Number	Description
5962-8771401PX	OP-14AZ/MD	Dual Matched High Performance Op Amp
5962-8771402GX	OP-14BJ/MD	Dual Matched High Performance Op Amp
5962-8771402PX	OP-14BZ/MD	Dual Matched High Performance Op Amp
5962-8954201GX	OP-15AJ/MD	Precision JFET-Input Op Amp
5962-8954201PX	OP-15AZ/MD	Precision JFET-Input Op Amp
5962-8954202GX	OP-15BJ/MD	Precision JFET-Input Op Amp
5962-8954301GX	OP-16AJ/MD	Precision JFET-Input Op Amp
5962-8954301PX	OP-16AZ/MD	Precision JFET-Input Op Amp
5962-8954302GX	OP-16BJ/MD	Precision JFET-Input Op Amp
5962-8954302PX	OP-16BZ/MD	Precision JFET-Input Op Amp
5962-8954303PX	OP-16CZ/MD	Precision JFET-Input Op Amp
5962-8770601GX	OP-17AJ/MD	Precision JFET-Input Op Amp
5962-8770601PX	OP-17AZ/MD	Precision JFET-Input Op Amp
5962-8770602GX	OP-17BJ/MD	Precision JFET-Input Op Amp
5962-8770602PX	OP-17BZ/MD	Precision JFET-Input Op Amp
5962-88593012X	OP-200ARC/MD	Dual Low Offset, Low Power Op Amp
5962-8859301PX	OP-200AZ/MD	Dual Low Offset, Low Power Op Amp
5962-8771501CX	OP-207AY/MD	Dual Ultralow V_{OS} Matched Op Amp
5962-8853801GX	OP-215AJ/MD	Dual Precision JFET-Input Op Amp
5962-88538012X	OP-215ARC/MD	Dual Precision JFET-Input Op Amp
5962-8853801PX	OP-215AZ/MD	Dual Precision JFET-Input Op Amp
5962-8853802GX	OP-215BJ/MD	Dual Precision JFET-Input Op Amp
5962-88538032X	OP-215BRC/MD	Dual Precision JFET-Input Op Amp
5962-8853802PX	OP-215BZ/MD	Dual Precision JFET-Input Op Amp
5962-8688701CX	OP-227AY/MD	Dual Low Noise, Low Offset Instr, Op Amp
5962-9053601GX	OP-260AJ/MD	Dual High Speed, Current Feedback Op Amp
5962-90536012X	OP-260ARC/MD	Dual High Speed, Current Feedback Op Amp
5962-9053601PX	OP-260AZ/MD	Dual High Speed, Current Feedback Op Amp
5962-88721012X	OP-270ARC/MD	Dual Very Low Noise, Precision Op Amp
5962-8872101PX	OP-270AZ/MD	Dual Very Low Noise, Precision Op Amp
5962-88721022X	OP-271ARC/MD	High Speed, Dual Op Amp
5962-8872102PX	OP-271AZ/MD	High Speed, Dual Op Amp
5962-8978301PX	OP-290AZ/MD	Precision, Low Power, Micropower Dual Op Amp
5962-89783012X	OP-290ARC/MD	Precision, Low Power, Micropower Dual Op Amp
5962-8853701GX	OP-37AJ/MD	Low Noise, Precision, High Speed Op Amp
5962-8853701PX	OP-37AZ/MD	Low Noise, Precision, High Speed Op Amp
5962-8853702GX	OP-37BJ/MD	Low Noise, Precision, High Speed Op Amp
5962-88537022X	OP-37BRC/MD	Low Noise, Precision, High Speed Op Amp
5962-8853702PX	OP-37BZ/MD	Low Noise, Precision, High Speed Op Amp
5962-8853703GX	OP-37CJ/MD	Low Noise, Precision, High Speed Op Amp
5962-87771013X	OP-400ATC/MD	Quad Low Offset, Low Power Op Amp
5962-8777101CX	OP-400AY/MD	Quad Low Offset, Low Power Op Amp
5962-8855901CX	OP-421BY/MD	Quad Low Power Op Amp (Single or Dual Supply)

SMD Part Number	Generic Part Number	Description
5962-8855902CX	OP-421CY/MD	Quad Low Power Op Amp (Single or Dual Supply)
5962-8851301GX	OP-42AJ/MD	High Speed, Fast Settling, Precision Op Amp
5962-88513012X	OP-42ARC/MD	High Speed, Fast Settling, Precision Op Amp
5962-8851301PX	OP-42AZ/MD	High Speed, Fast Settling, Precision Op Amp
5962-8980401GX	OP-44AJ/MD	High Speed, Precision Op Amp
5962-8980401PX	OP-44AZ/MD	High Speed, Precision Op Amp
5962-89804012X	OP-44ARC/MD	High Speed, Precision Op Amp
5962-9053501GX	OP-64AJ/MD	High Speed, Wide Bandwidth Op Amp
5962-9053501PX	OP-64AZ/MD	High Speed, Wide Bandwidth Op Amp
5962-90535012X	OP-64ARC/MD	High Speed, Wide Bandwidth Op Amp
5962-88565012X	OP-470ARC/MD	Very Low Noise, Quad Op Amp
5962-88565013X	OP-470ATC/MD	Very Low Noise, Quad Op Amp
5962-8856501CX	OP-470AY/MD	Very Low Noise, Quad Op Amp
5962-88565022X	OP-471ARC/MD	High Speed, Low Noise, Quad Op Amp
5962-88565023X	OP-471ATC/MD	High Speed, Low Noise, Quad Op Amp
5962-8856502CX	OP-471AY/MD	High Speed, Low Noise, Quad Op Amp
5962-8967001CX	OP-490AY/MD	Low Voltage, Micropower, Quad Op Amp
5962-89670013X	OP-490ATC/MD	Low Voltage, Micropower, Quad Op Amp
5962-8967301CX	OP-50AY/MD	High Output-Current Op Amp (AVCL ≥5)
5962-8967302CX	OP-50BY/MD	High Output-Current Op Amp (AVCL ≥5)
5962-8773802GX	OP-77AJ/MD	Next Generation OP-07 (Ultralow Offset Voltage Op Amp)
5962-8773802PX	OP-77AZ/MD	Next Generation OP-07 (Ultralow Offset Voltage Op Amp)
5962-8773801GX	OP-77BJ/MD	Next Generation OP-07 (Ultralow Offset Voltage Op Amp)
5962-87738012X	OP-77BRC/MD	Next Generation OP-07 (Ultralow Offset Voltage Op Amp)
5962-8773801PX	OP-77BZ/MD	Next Generation OP-07 (Ultralow Offset Voltage Op Amp)
5962-8954401GX	OP-97AJ/MD	Low Power, High Precision Op Amp
5962-8954401PX	OP-97AZ/MD	Low Power, High Precision Op Amp
5962-8980701RA	AD630SD/883B	Balanced Modulator/Demodulator
5962-89807012A	AD630SE/883B	Balanced Modulator/Demodulator
5962-8963701CA	AD637SQ/883B	Wideband RMS-DC Converter
5962-8980901EA	AD539SD/883B	High Speed, 2-Channel, 2 Quadrant Multiplier

MIL-STD-883 Class B Products

AD2S80	AD570	AD707	AD7224	AD7579	ADSP-1009A	DAC-01	OP-12	OP-490
AD2S80A	AD571	AD708	AD7225	AD7580	ADSP-1010A	DAC-05	OP-14	PKD-01
AD346	AD572	AD711	AD7226	AD7582	ADSP-1010B	DAC-06	OP-15	PM-108
AD380	AD573	AD712	AD7228	AD7590/1DI	ADSP-1012A	DAC-08	OP-16	PM-111
AD381	AD574A	AD713	AD7237	AD7592DI	ADSP-1016A	DAC-10	OP-17	PM-119
AD382	AD578	AD734	AD7245	AD7628	ADSP-1024A	DAC-100	OP-20	PM-139
AD386	AD579	AD741	AD7247	AD7672	ADSP-1080A/81A	DAC-312	OP-21	PM-148
AD390	AD580	**AD744**	AD7248	AD7820	ADSP-1101	DAC-888	OP-22	PM-155
AD394	AD581	AD746	AD7501	AD7821	ADSP-1110	DAC-1508	OP-27	PM-156
AD395	AD582	AD767	AD7502	AD7824	ADSP-1401/10	DAC-8012	OP-32	PM-157
AD396	AD584	AD790	AD7503	AD7828	ADSP-1402	DAC-8043	OP-37	PM-1008
AD509	AD585	AD834	AD7506	AD7840	ADSP-2100 & A	DAC-8143	OP-41	PM-1012
AD517	AD586	AD840	AD7507	AD7845	ADSP-2101	DAC-8212	OP-42	PM-2108
AD518	AD587	AD841	AD7510DI	AD7846	ADSP-2111	DAC-8221	OP-43	PM-7224
AD521	**AD588**	AD842	AD7511DI	AD7870	ADSP-3128A	DAC-8222	OP-44	PM-7226
AD522	AD589	AD843	AD7512DI	AD9000	ADSP-3201/02	DAC-8229	OP-50	PM-7524
AD524	AD590	AD844	AD7520	AD9002	ADSP-3210/20	DAC-8248	OP-61	PM-7528
AD526	AD624	AD845	AD7521	AD9012	ADSP-3211	DAC-8408	OP-64	PM-7533
AD532	AD625	AD846	AD7522	AD9048	ADSP-3212/22	DAC-8800	OP-77	PM-7541
AD534	AD630	AD847	AD7524	**AD9610**	ADSP-3220	MAT-01	OP-90	PM-7541A
AD536A	AD632	AD848	AD7528	AD96687	ADSP-3221	MAT-02	OP-97	PM-7542
AD537	AD637	AD849	AD7533	AD ADC85S-12	ADV453	MAT-03	OP-160	PM-7543
AD538	AD639	AD1330	AD7534	**AD ADC85SZ-12**	ADVFC32	MAT-04	OP-177	PM-7545
AD539	AD640	AD1332	AD7535	AD DAC87	HDS-1250	MUX-08	OP-200	PM-7548
AD542	AD642	AD1334	AD7536	ADG201A & HS	HOS-050A/060SH	MUX-16	OP-207	PM-7574
AD544	AD644	AD1341	AD7537	ADG202A	HTC-0300A	MUX-24	OP-215	PM-7628
AD547	AD647	AD1362	AD7541 & A	ADG221	ADC-908	MUX-28	OP-220	PM-7645
AD548	AD648	AD1378	AD7542	ADG222	ADC-910	OP-01	OP-221	REF-01
AD549	AD650	AD2700	AD7543	ADG506A/507A	ADC-912	OP-02	OP-227	REF-02
AD558	AD652	AD2701	AD7545 & A	ADG508A/509A	AMP-01	OP-04	OP-249	REF-05
AD561	**AD664**	AD2702	AD7547	ADG526A/527A	AMP-02	OP-05	OP-260	REF-08
AD562	AD667	AD3860	AD7548/49	ADG528A/529A	AMP-05	OP-06	OP-270	REF-10
AD563	**AD668**	AD5200 Series	AD7569	AD OP-07	BUF-03	OP-07	OP-271	REF-43
AD565A	AD670	AD5210 Series	AD7572	AD OP-27	CMP-01	OP-08	OP-290	SMP-11
AD566A	AD673	AD5240	AD7574	AD OP-37	CMP-04	OP-08	OP-400	SW-01
AD567	AD674A	AD5539	AD7575	ADREF01	CMP-05	OP-09	OP-420	SW-06
AD568	**AD688**	AD7111	AD7576	ADREF02	CMP-08	OP-10	OP-421	SW-201
AD569	AD689	AD7118	AD7578	ADSP-1008A	CMP-404	OP-11	OP-470	SW-7510
							OP-471	SW-7511

Boldface indicates new MIL-STD-883 Class B Product availability since publication of our most recent Databooks. For status of specific parts, please contact your local salesperson. Due to the nature of slash sheet and MIL drawing development, the availability of parts is difficult to predict. This list will be updated and published in *Analog Briefings* every six months.

JAN QPL Class B Products

JAN Part Number	Generic Part Number	Description
JM38510/14001BXA	AD574AUD	Complete, 12-Bit ADC
JM38510/14002BXA	AD574ATD	Complete, 12-Bit ADC
JM38510/12101BJC	AD562SD	12-Bit Current Output DAC
JM38510/12103BJC	AD565SD	12-Bit Current Output DAC
JM38510/12702BEC	AD7520UD	10-Bit Multiplying DAC
JM38510/13301BEA	AD561SD	10-Bit DAC, I-Out
38510/11302BEA	DAC08 AQ5	8-Bit D/A Converter
38510/11302BEB	DAC08 AQ2	8-Bit D/A Converter
38510/11301BEA	DAC08 Q5	8-Bit D/A Converter
38510/11301BEB	DAC08 Q2	8-Bit D/A Converter
JM38510/12801BGC, A	AD584SH	Multi-Tap Reference
JM38510/12802BGC, A	AD584TH	Multi-Tap Reference
JM38510/13901BIA	AD534TH	Analog Multiplier, Prog. Scale
JM38510/13901BCA	AD534TD	Analog Multiplier, Prog. Scale
JM38510/13902BCA	AD534SD	Analog Multiplier, Prog. Scale
JM38510/13902BIA	AD534SH	Analog Multiplier, Prog. Scale
JM38510/13903BIA	AD532SH	Analog Multiplier, Fixed Scale
JM38510/13903BCA	AD532SD	Analog Multiplier, Fixed Scale
38510/13501BGA	OP07 AJ5	Low Offset Op Amp
38510/13501BCG	OP07 AJ1	Low Offset Op Amp
38510/13501BPA	OP07 AZ5	Low Offset Op Amp
38510/13501BPB	OP07 AZ2	Low Offset Op Amp
38510/13502BGA	OP07 J5	Low Offset Op Amp
38510/13502BGC	OP07 J1	Low Offset Op Amp
38510/13502BPA	OP07 Z5	Low Offset Op Amp
38510/13502BPB	OP07 Z2	Low Offset Op Amp
38510/13503BGA	OP27 AJ5	Low Noise Precision Op Amp
38510/13503BGC	OP27 AJ1	Low Noise Precision Op Amp
38510/13503BPA	OP27 AZ5	Low Noise Precision Op Amp
38510/13503BPB	OP27 AZ2	Low Noise Precision Op Amp
38510/11404BGA	LF155/PM155 AJ5	BiFET Op Amp
38510/11404BGC	LF155/PM155 AJ1	BiFET Op Amp
38510/11404BPA	LF155/PM155 AZ5	BiFET Op Amp
38510/11404BPB	LF155/PM155 AZ2	BiFET Op Amp
38510/11401BGA	LF155/PM155 J5	BiFET Op Amp
38510/11401BGC	LF155/PM155 J1	BiFET Op Amp
38510/11401BPA	LF155/PM155 Z5	BiFET Op Amp
38510/11401BPB	LF155/PM155 Z2	BiFET Op Amp
38510/11405BGA	LF156/PM156 AJ5	BiFET Op Amp
38510/11405BGC	LF156/PM156 AJ1	BiFET Op Amp
38510/11405BPA	LF156/PM156 AZ5	BiFET Op Amp
38510/11405BPB	LF156/PM156 AZ2	BiFET Op Amp
38510/11402BGA	LF156/PM156 J5	BiFET Op Amp
38510/11402BGC	LF156/PM156 J1	BiFET Op Amp
38510/11402BPA	LF156/PM156 Z5	BiFET Op Amp
38510/11402BPB	LF156/PM156 Z2	BiFET Op Amp
38510/11406BGA	LF157/PM157 AJ5	BiFET Op Amp
38510/11406BGC	LF157/PM157 AJ1	BiFET Op Amp
38510/11406BPA	LF157/PM157 AZ5	BiFET Op Amp
38510/11406BPB	LF157/PM157 AZ2	BiFET Op Amp
38510/11403BGA	LF157/PM157 J5	BiFET Op Amp
38510/11403BGC	LF157/PM157 J1	BiFET Op Amp
38510/11403BPA	LF157/PM157 Z5	BiFET Op Amp
38510/11403BPB	LF157/PM157 Z2	BiFET Op Amp
38510/11201BCB	LM139/PM157 Y2	Quad Low Power Voltage Comparator
38510/11201BCA	LM139/PM139 Y5	Quad Low Power Voltage Comparator
38510/10304BCA	LM111/PM111 Y5	Voltage Comparator
38510/10304BCB	LM111/PM111 Y2	Voltage Comparator
38510/10304BGA	LM111/PM111 J5	Voltage Comparator
38510/10101BGA	741A/PM741 AJ5	General Purpose Op Amp
38510/10101BCG	741A/PM741 AJ1	General Purpose Op Amp
38510/10104BGA	LM108/PM108 AJ5	Low Input-Current Op Amp
38510/10104BGC	LM108/PM108 AJ1	Low Input-Current Op Amp
38510/10104BPA	LM108/PM108 AZ5	Low Input-Current Op Amp
38510/10104BPB	LM108/PM108 AZ2	Low Input-Current Op Amp
38510/10106BEA	LH2108A/PM2108AQ5	Dual Op Amp
38510/10106BEB	LH2108A/PM2108AQ2	Dual Op Amp
38510/11004BCA	4136/PM4136 Y5	Quad Op Amp
38510/11004BCB	4136/PM4136 Y2	Quad Op Amp

Gold and tin reflow lead parts will be built to order only. Hot Solder dip is the preferred and stocked lead finish.

JAN QPL Class S Products

Precision Monolithics (PMI) and Analog Devices, Inc. (ADI) have combined resources and offer a full range of products with Class "S" processing:

- MIL-M-38510 QPL "S" reference SEC IV
- ADI will soon be offering the following part types in Class "S" conforming to MIL-STD-883, Para. 1.2.1:

Class "S"	Description
AD590	Monolithic Temperature Transducer
AD534	Precision Analog Multiplier
AD574	12-Bit Analog A/D Converter
AD584	10, 5, 2.5 Voltage Pin Programmable Precision Voltage Reference

- A Standard Class "S" Program has been developed offering Class "S" devices which fully satisfies the customer's needs for full process control, traceability, reliability, lot qualifications, certified line, and the recorded data generally associated with Class "S" processing. ADI Standard Class "S" processing is based on MIL-STD-883, Methods 5004 and 5005, Class "S" flow and can be applied to any SMD or 883 military part listed herein Sec I or Sec II. The electrical parameters and endpoints for the ADI Standard Class "S" flow will be as described in the current PMI/ADI 883 data sheet catalog. The factory must be consulted for delta parameters and limits, burn-in circuit, methods, and anomalies for PDA information, until complete ADI Standard Class "S" specification sheets, by product, are available.

  The newest additions to the Standard Class "S" are parts listed in Section I, II are the following:

2S80	Resolver to Digital Converter
AD9048	35 MSPS, Video 8-Bit A/D Converter, 550 mW
AD9002	150 MSPS, 8-Bit A/D Converter, ECL, 750 mW
AD9012	100 MSPS, 8-Bit A/D Converter, TTL, 1 W
AD9060	75 MSPS, 10-Bit A/D Converter

Additional devices will be added in 1991–1992.

PMI Division will continue to offer Class "B" and Class "S" processing to Source Control Drawings (SCD) and is also capable of handling Radiation Testing requirements. The radiation data base information gathered from ADI/PMI devices will be managed and distributed by the PMI Division of ADI.

JAN Part Number	Generic Part Number	Description	Part I Qual
38510/13501SGA	OP07 AJ5	Low Offset Op Amp	Yes
38510/13501SPA	OP07 AZ5	Low Offset Op Amp	Yes
38510/13502SGA	OP07 J5	Low Offset Op Amp	Yes
38510/13502SPA	OP07 Z5	Low Offset Op Amp	Yes
38510/13503SGA	OP27 AJ5	Low Noise Precision Op Amp	Yes
38510/13503SPA	OP27 AZ5	Low Noise Precision Op Amp	Yes
38510/11404SGA	LF155/PM155 AJ5	BiFET Op Amp	Yes
38510/11404SPA	LF155/PM155 AZ5	BiFET Op Amp	Yes
38510/11401SGA	LF155/PM155 J5	BiFET Op Amp	Yes
38510/11401SPA	LF155/PM155 Z5	BiFET Op Amp	Yes
38510/11405SGA	LF156/PM156 AJ5	BiFET Op Amp	Yes
38510/11405SPA	LF156/PM156 AZ5	BiFET Op Amp	Yes
38510/11402SGA	LF156/PM156 J5	BiFET Op Amp	Yes
38510/11402SPA	LF156/PM156 Z5	BiFET Op Amp	Yes
38510/11201SEA	LM139/PM139 AY5	Quad Low Power Voltage Comp.	Yes
38510/10101SGA	741 A/PM741 AJ5	General Purpose Op Amp	Nov, 90
38510/10104SGA	LM108/PM108 AJ5	Low Input-Current Op Amp	Jan, 91
38510/11302SEA	DAC08 AQ5	8-Bit D/A Converter	Yes
38510/11301SEA	DAC08 Q5	8-Bit D/A Converter	Yes
38510/12208SGA	OP42 AJ5	High Speed Precision Op Amp	Q3, 91
38510/12208SPA	OP42 AZ5	High Speed Precision Op Amp	Q3, 91
38510/12207SGA	OP44 AJ5	High Speed Precision Op Amp	Q3, 91
38510/12207SPA	OP44 AZ5	High Speed Precision Op Amp	Q3, 91
38510/10304SGA	LM111/PM111 J5	Voltage Comparator	Q2, 91
38510/10304SPA	LM111/PM111 Z5	Voltage Comparator	Q2, 91
38510/135xxSPA**	OP200 AZ5	Dual Low Power/Offset Op Amp	Q3, 91
38510/135xxSCA**	OP400 AY5	Quad Low Power/Offset Op Amp	Q3, 91

**In the future, these parts may identified in the new DESC "One Part, One Part Number" system, i.e.,

Part Number	PMI Part Number
5962-8859301SPA	OP200 AZ5
5962-8777101SCA	OP400 AY5

Product Families Still Available

The information published in this Reference Manual is intended to assist the user in choosing components for the design of *new* equipment, using the most cost-effective products available from Analog Devices. The popular product types listed below may have been designed into your circuits in the past, but they are no longer likely to be the most economic choice for your new designs. Nevertheless, we recognize that it is often a wise choice to refrain from redesigning proven equipment, and we are continuing to make these products available for use in existing designs. Data sheets on these products are available upon request.

Model	Model	Model	Model	Model
AD101	AD7110	DAC-20	RDC-1702	184
AD201	AD7240	DAC71/72	RDC-1704	234
AD293	AD7520	DAC-86	RDC-1725	235
AD294	AD7521	DAC-88	RDC-1726	261
AD301	AD7522	DAC-89	RDC-1768	275
AD301AL	AD7523	DAC-210	RTM Series	277
AD367	AD7525	DAC-888	SDC1700	285
AD368	AD7530	DAC1108	SDC1702	288
AD369	AD7531	DAC1136	SDC1704	310
AD370/371	AD7541	DAC1138	SDC1725	429
AD392	AD7546	DAC1146	SDC1726	433
AD503	AD7550	DAC-1408A	SDC1768	434
AD504	AD7552	DAC1420	SHA-5	435
AD506	AD7576	DAC1422	SHA-1134	436
AD510	AD7772	DAC1423	SHA-1144	440
AD515	AD9502	DAC1508A	SMP-81	442
AD518	AD9611	DAC-8212	STM Series	450
AD533	AD9686	DAS1128	SW-01/02	451
AD535	ADC-908	DAS1150	SW-7510/7511 2B24	452
AD545	ADC-912	DAS1151	2B34	453
AD567	ADC1130	DAS1155	2B35	458
AD611	ADC1131	DAS1156	2B50	460
AD651	ADC1143	DRC1705	2B52	603
AD1147	ADC-12QM	DRC1706	2B53	751
AD1148	AD DAC-08	DSC1705	2B56	756
AD1403	AD DAC71	DSC1706	2B57	903
AD2004	AD DAC72	HDS-1240E	2B58	906
AD2006	ADEB770	HOS-050/050A/050C	2B59	915
AD2008	CAV-1210	HOS-060	4B Series	926
AD2009	DAC-QS	HTC-0300A	40	947
AD2016	DAC-QZ	HTS-0010	44	959
AD2020	DAC-01	HTS-0025	45	968
AD2033	DAC-02/03	JM38510/11301/11302	46	972
AD2040	DAC-05/06	MUX-88	50	
AD3554	DAC-10Z	PM-562	51	
AD3860	DAC-12M	PM-7541	118	
AD5200 Series	DAC-12QS	PM-7574	148	
AD5210 Series	DAC-12QZ	RDC-1700	171	

When contacting suppliers, say you saw it in IC MASTER

Analog Devices

Substitution Guide for Product Families No Longer Available

The products listed in the left-hand column are no longer available from Analog Devices. In many cases, comparable functions and performance may be obtained with newer models, but—as a rule—they are not directly interchangeable. The closest recommended Analog Devices equivalent, physically and electrically, is listed in the right-hand column. If no equivalent is listed, or for further information, contact your local sales office.

Model	Closest Recommended Equivalent	Model	Closest Recommended Equivalent	Model	Closest Recommended Equivalent	Model	Closest Recommended Equivalent
AD108/208/308	AD705	AD1508	AD558	ADC-12QZ	AD574A/AD674A	CMP-05GJ	CMP-05CJ
AD108A/208A/308A	AD705	AD1678	AD678	ADC-14I/17I	AD1170	CMP-404BY	CMP-404AY
AD111/211/311	AD790	AD1679	AD679	ADC-1100	AD7550/AD7552	CMP-404BY/883C	CMP-404AY/883C
AD345	AD1321/1322	AD1779	AD779	ADC1102	AD7870	DAC-02ACX1	DAC-02CCX1
AD351	AD790	AD2003	AD2021	ADC1103	AD7572A	DAC-05AX1	DAC-02CCX1
AD362	AD1362	AD2022	None	ADC1105	AD7550/AD7552	DAC-05EX1	DAC-02CCX1
AD376	AD1376	AD2023	None	ADC1109	AD7572A	DAC-10BX	DAC-10FX
AD501	AD711	AD2024	None	ADC1111	AD574A	DAC-10CX	DAC-10GX
AD502	AD711	AD2025	None	ADC1121	AD7880	DAC-10DF	AD568
AD505	AD509	AD2027	None	ADC1123	AD7880	DAC-10H	DAC-10Z
AD508	AD517	AD2028	None	ADC1133	AD574A	DAC-14QM	DAC1136
AD511	AD711	AD2036	None	ADC-QM	AD574A/AD674A	DAC-16QM	DAC1136
AD512	AD711	AD2037	None	ADC-QU	AD574A/AD674A	DAC-100AAQ7	DAC-100ACQ7
AD513	AD711	AD2038	None	AD DAC100	AD561	DAC-100AAQ8	DAC-100ACQ8
AD514	AD711	AD5010/6020	AD9000	ADG200	None	DAC-100ABQ7	DAC-100ACQ7
AD516	AD711	AD6012	AD565A	ADG201	ADG201A	DAC-100ABQ8	DAC-100ACQ8
AD520	AD524	AD7115	AD7111	ADLH0032G/CG	AD843	DAC-100BBQ5/883C	DAC-100ACQ5/883C
AD523	AD549	AD7513	ADG201A	ADLH0033G/CG	AD9620/AD9630		
AD528	AD711/744	AD7516	AD7510DI	ADM501	None	DAC-100BCQ7	DAC-100BBQ7
AD530	AD533	AD7519	None	ADP501	None	DAC-100DDQ7	DAC-100CCQ7
AD531	AD532	AD7527	AD7548	ADREF01	REF-01	DAC-312BR	DAC-312ER
AD540	AD544	AD7544	AD7548	ADREF02	REF-02	DAC-888AX	DAC-888EX
AD559	AD557/AD558	AD7555	AD1175K	ADSHC-85	AD585	DAC-888BX	DAC-888EX
AD565	AD565A	AD7560	None	ADSHM-5	HTC-0300A	DAC1009	AD767
AD566	AD566A	AD7570	AD7579/AD7580	AMP-01BX	AMP-01AX	DAC1106	AD568
AD612	AD524	AD7571	AD7579/AD7580	AMP-01BX/883C	AMP-01AX/883C	DAC1112	DAC12QS
AD614	AD524	AD7583	AD7880+MUX	AMP-05BX	AMP-05AX	DAC1118	AD767
AD689	AD586	AD9011	AD9002	AMP-05BX/883C	AMP-05Z/883C	DAC1122	AD7541A
AD801	AD711	AD9521	AD640	API1620/1718	Consult ADI	DAC1125	AD7533
AD810-813	None	AD9615	AD9611/AD9617	BDM 1615/16/17	None	DAC1132	AD667
AD814-816	None	AD9685	AD96685	BUF-03BJ/883C	BUF-03AJ/883C	DAC-1408-6P	DAC-1408-8P
AD818	None	AD9687	AD96686	CAV-0920/1020	AD9020/9060	DAC-1408-7P	DAC-1408-8P
AD820-822	None	AD9688	AD9002/AD9028	CAV-1202	AD9005	DAC-1408-7Q	DAC-1408-8Q
AD830-833	None	AD ADC-816	AD7820/AD7821	CAV-1205	AD9005	DAC-1408-GQ	DAC-1408-8Q
AD835-839	None	ADC-8S	AD673	CMP-01Z	CMP-01J	DAC-1508A-8Q	DAC-1408-8Q
AD1145	AD7846	ADC-10Z	AD574A	CMP-05BJ	CMP-05CJ	DRC1605/06	DRC1705/06; SDC1740
AD1408	AD558	ADC-12QL	AD7578	CMP-05BZ	CMP-05CZ	DRC1765/66	AD2S65/66

Model	Closest Recommended Equivalent
DSC1605/06	DSC1705/06; SDC1740
DSC1765/66	AD2S65/66
DTM1716/17	AD2S65/66
HAS-0802	HAS1202A
HAS-1002	HAS1202A
HAS-1202	HAS1202A
HDD-1015	AD9712A
HDD-1409	None
HDG-0805	AD9701
HDH-0802	AD9713A
HDH-1003	AD9713A
HDH-1205	AD9713A
HDL-3805	ADV453/ADV478
HDL-3806	ADV453/ADV478
HDM-1210	AD668/AD9713A
HDS-0810E	AD9712A
HDS-0820	AD9713A
HDS-1015E	AD9712A
HDS-1025	AD9713A
HDS-1250	AD668/AD9713A
HOS-100AH/SH	None
HOS-200	AD9620/30
HTC-0300	HTC-0300A
HTC-0500	HTC-0300A
IPA-1751	IPA-1764
IRDC1730-33	AD2S80A/82A
MAH-0801	AD9005
MAH-1001	AD9005
MAS-0801	AD9005
MAS-1001	AD9005
MAS-1202	AD9005
MAT-01/883C	MAT-01AH/883C
MAT-02BH	MAT-02AH
MAT-02BH/883C	MAT-02AH/883C
MATV-0811	AD9012/48
MATV-0816	AD9012/48
MATV-0820	AD9012/48
MCI-1794	AD2S80A/82A
MDA Family	AD9712A/13A
MDH Family	AD9712A/13A
MDMS Family	AD9712A/13A
MDS Family	AD9712A/13A
MDSL Family	AD9712A/13A
MOD-1005/20	AD9020/60
MUX-08AQ	MUX-08BQ
MUX-24AQ	MUX-24EQ
MUX-24BQ	MUX-24FQ
MUX-16AT	MUX-16ET
MUX-16BT	MUX-16FT
OP-01HJ	OP-01J
OP-01HZ	OP-01HP
OP-02BJ	OP-02AJ
OP-02BJ/883C	OP-02AJ/883C
OP-02EJ	OP-07DJ
OP-02EP	OP-177GP
OP-02EZ	OP-177GZ
OP-02J	OP-02AJ
OP-02/883C	OP-02AZ/883C
OP-04DY	OP-04CY
OP-04GBC	OP-04NBC
OP-04Y/883C	OP-04AY/883C
OP-05Z	OP-05AZ
OP-05/883C	OP-05AZ/883C
OP-06BJ/883C	OP-06AJ/883C
OP-06EZ	OP-06GZ
OP-06FZ	OP-06GZ
OP-08AJ	PM-1008AJ
OP-08AJ/883C	PM-1008AJ/883C
OP-08AZ/883C	PM-1008AZ/883C
OP-08CZ/883C	PM-1008AZ/883C
OP-08EJ	PM-1008EJ
OP-08EZ	PM-1008EZ
OP-09ARC/883C	OP-11ARC/883C
OP-09FY	OP-09EY
OP-12BZ	OP-12AZ
OP-12CZ	OP-12AZ
OP-12GZ	OP-12FZ
OP-14DZ	OP-14CZ
OP-14GRBC	OP-14GBC
OP-14J/883C	OP-14AJ/883C
OP-15BJ	OP-15AJ
OP-15BZ	OP-15AZ
OP-16BJ	OP-16AJ
OP-17BZ/883C	OP-17AZ/883C
OP-17CJ	OP-17AJ
OP-17FJ	OP-17EJ
OP-17FZ	OP-17EZ
OP-20CJ	OP-20BJ
OP-21GRBC	OP-21GBC
OP-215BJ	OP-215AJ
OP-215BJ/883C	OP-215AJ/883C
OP-215BZ	OP-215AZ
OP-215CZ/883C	OP-215BZ/883
OP-21BJ	OP-21AJ
OP-21BZ	OP-21AZ
OP-21EJ	OP-21AJ
OP-220BJ	OP-220AJ
OP-22AJ	OP-22AJ/883C
OP-22EJ	OP-22AJ/883C
OP-32BZ	OP-32AZ
OP-32BZ/883C	OP-32AZ/883C
OP-32FZ	OP-32EZ
OP-50BY	OP-50AY
OP-50BY/883C	OP-50AY/883C
OSC-1754	OSC-1758
PKD-01BY	PKD-01AY
PKD-01BY/883C	PKD-01AY/883C
PM-111Y	PM-111J
PM-11Y/883C	PM-111J/883C
PM-139AY	PM-139AY/883C
PM-156AZ	PM-156AZ/883C
PM-157J	PM-175J/883C
PM-157J/883C	PM-157AJ/883C
PM-208AJ	PM-108AJ/883C
PM-208AZ	PM-108AZ
PM-308AZ	PM-1008GZ
PM-308J	PM-1008G
PM-4136RC	OP-11ARC/883C
PM-562AV	PM-562HV
PM-562BV	PM-562HV
PM-562FV	PM-562HV
PM-562GV	PM-562HV
PM-741J	OP-02AJ
RAC1763	None
RDC1602/03	RDC1702/03
RDC1711	None
RDC1721	AD2S46
RDC1767	RDC1768
RSCT1621	AD2S80A/82A
RTI-1200	RTI-711 Series
RTI-1201	RTI-711 Series
RTI-1202	RTI-711 Series
RTM1630-34	RTM1680/83
RTM1636	Consult ADI
RTM1660/63/71/72	Consult ADI
RTM1679	None
RTM1681/86/87/89	Consult ADI
RTM1690/96	Consult ADI
RTM1697	None
RTM1736/37	RDC1740 + CCT
SAC1763	None
SBCD1752/53/56/57	None
SCDX1623	None
SCM1677	None
SDC1602/3/4	SDC1702/03/04/40
SDC1711	None
SDC1721	AD2S46
SDC1767	SDC1768
SERDEX	μMAC-5000
SHA-1A	AD585
SHA-2A	AD781
SHA-3	AD585
SHA-4	AD585
SHA-6	AD1154
SHA1114	AD585
SMP-10BY	SMP-10AY
SMP-10BY/883C	SMP-10AY/883C
SPA-1695	None
SSCT1621	AD2S80A/82A
SSCT1622/23	None
STM1630-34	STM1680/83
STM1636	Consult ADI
STM1660/63/71/72	Consult ADI
STM1679	None

Analog Devices

Substitution Guide for Product Families No Longer Available

Model	Closest Recommended Equivalent	Model	Closest Recommended Equivalent	Model	Closest Recommended Equivalent
STM1681/86/87/89	Consult ADI			932	None
STM1690/96	Consult ADI	183	184	933	None
STM1697	None	220	234	935	None
STM1736/37	SDC1740 + CCT	230	235	942	None
SW-01BQ	SW-01FQ	231	233	944	None
SW-7510AQ	SW-7510EQ	232	235	946	None
SW-7510BQ	SW-7510FQ	233	None	948	947
SW-7511AQ	SW-1577BQ	260	AD707	950	None
THC-Family	HTC-0300A	272	None	956	None
THS-Family	HTC-0300A	273	None	971	921
TSL1612	Consult ADI	276	None		
1S10/20	1S40; AD2S80A/82A	274J	284J		
1S14/24/44/64	1S74	279	286J		
1S61	1S60; AD2S80A/82A	280	281		
2S20	AD2S80A/82A	282J	292A		
5S70/5S72	AD2S75	283J	292A		
9S70/71/72	None	287	None		
9S75/76/79	None	301	310 (Module)		
41	AD515A	302	310 (Module)		
42	AD549	311	AD549		
43	AD549	350	None		
47	AD845	424	435/AD534		
48	AD845	426	AD534		
52	AD707	427	None		
102	AD845	428	AD538		
106	118	432	None		
107	118	454	AD537		
108	AD845	456	AD537		
110	AD845	602J10	AD524		
120	50	602J100	AD524		
141	40	602K100	AD524		
142	AD845	603	AD524		
143	AD845	605	AD524		
146	AD382	606	AD625		
149	50	610	AD625		
153	AD517	752	759		
161	None	901	904		
163	None	907	921		
165	None	908	921		
170	None	909	921		
180	AD OP-07	931	None		

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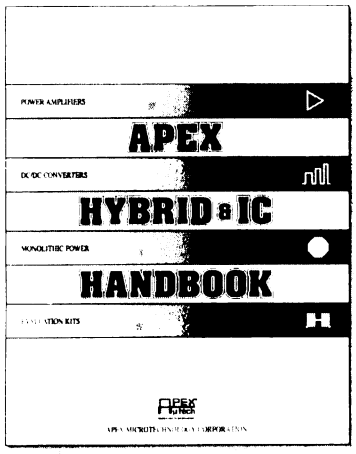

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PA10M/883	5962-9082801HXC
PA12M/883	5962-9065901HXC
PA51M/883	5962-8762002YC
High Voltage	
PA08M/883	5962-9072301HXC
PA83M/883	5962-9162101HXC
PA84M/883	5962-9073601HXC
High Speed	
PA09M/883	SMD Part # Pending*

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HIGH VOLTAGE

Model	±Supply Range Volts Min/Max	Output Current (Cont.) mA, Min	Saturation @I_OMax (V_S-V_O) Volts, Max	Internal Power Watts Max	Slew Rate V/µs Typ	V_{OS} Initial mV Max	V_{OS} vs Temp µV/°C Max	Bias Current nA Max	I_q mA Max	Gain BW Product MHz Typ	Current Limit (Amps)	Thermal Shutdown	Temp Range °C Min/Max
PA89	50/600	100	36	40	1.2	2	30	.05	4	2	Ext Adj	No	–25/85
PA89A	*	*	*	*	*	.5	10	.01	*	*	*	*	*
PA85	15/225	200	10	35	1000	2	30	.05	25	110	Ext Adj	Yes	–25/85
PA85A	*	*	*	*	*	.5	10	.01	*	*	*	*	*
PA85M	*	*	*	*	*	2	30	.05	*	*	*	*	–55/125
PA88	15/225	100	10	15	30	2	30	.05	2	10	Ext Adj	No	–25/85
PA88A	*	*	*	*	*	.5	10	.01	*	*	*	*	*
PA41	50/175	60	12	12	40	30	65	.05	2	1.6	Ext Adj	No	–25/85
PA41A	50/175	60	10	12	40	60	130	.05	1.8	1.6	Ext Adj	No	–25/85
PA08V	15/175	150	15	17.5	30	2	30	.05	8.5	5	Ext Adj	Yes	–25/85
PA08	15/150	*	*	*	*	*	*	*	*	*	*	*	*
PA08A	*	*	*	*	*	.5	10	.01	*	*	*	*	*
PA08M	*	*	*	*	*	2	30	.05	*	*	*	*	–55/125
PB58	15/150	1500	11	80	100	1500	7000	—	12	2.5	Ext Adj	No	–25/85
PB58A	*	2000	*	*	*	1000	*	—	*	*	*	*	*
PA83	15/150	75	10	17.5	30	3	25	.05	8.5	5	(.1)	Yes	–25/85
PA83A	*	*	*	*	*	1	10	.01	*	*	*	*	*
PA83M	*	*	*	*	*	3	25	.05	*	*	*	*	–55/125
PA84	15/150	40	7	17.5	200	3	25	.05	7.5	76	(.05)	Yes	–25/85
PA84A	*	*	*	*	*	1	10	.01	*	*	*	*	*
PA84M	*	*	*	*	*	3	25	.05	*	*	*	*	–55/125
PA84S	*	*	*	*	*	*	*	*	*	*	*	*	–25/85
PA82J	70/150	15	5	11.5	20	3	25	.05	8.5	5	(.025)	Yes	0/70
PB50	30/100	2000	11	35	100	1750	7000	—	18	2.5	Ext Adj	No	–25/85
PA81J	32/75	30	5	11.5	20	3	25	.05	8.5	5	(.05)	Yes	0/70

†Specifications apply for T_C = 25°C, unless otherwise stated. *Specification is same as above.

HIGH SPEED

Model	Slew Rate V/µs Typ	Output Current (Cont.) Amps., Min	±Supply Range Volts Min/Max	Saturation @I_OMax (V_S-V_O) Volts, Max	Internal Power Watts Max	V_{OS} Initial mV Max	V_{OS} vs Temp µV/°C Max	Bias Current nA Max	I_q mA Max	Gain BW Product MHz Typ	Current Limit (Amps)	Thermal Shutdown	Temp Range °C Min/Max
WA01	5000	.4	12/16	4	10.5	10	5.	20000	30	—	(.6)	No	–25/85
WA01A	*	*	*	*	*	5	25	10000	*	*	*	*	*
WB05	10000	1	5/15	6.5	15	100	500	30000	30	250	(1.5)	No	–25/85
PA85	1000	.2	15/225	10	35	2	30	.05	25	110	Ext Adj	Yes	–25/85
PA85A	*	*	*	*	*	.5	10	.01	*	*	*	*	*
PA85M	*	*	*	*	4	2	30	.05	*	*	*	*	–55/125
PA19	900	4	15/40	5	78	3	30	.2	120	100	Ext Adj	Yes	–25/85
PA19A	*	*	*	*	*	.5	10	.05	*	*	*	*	*
PA09	400	2	12/40	8	78	3	30	.1	85	150	(4.5)	Yes	–25/85
PA09A	*	*	*	*	*	.5	10	.02	*	*	*	*	*
PA09M	*	*	*	*	*	3	30	.1	*	*	*	*	–55/125

†Specifications apply for T_C = 25°C, unless otherwise stated. *Specification is same as above.

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HIGH POWER/DC-DC CONVERTERS
SELECTOR GUIDE

APEX MICROTECHNOLOGY CORPORATION • TUCSON, ARIZONA • APPLICATIONS HOTLINE (800) 421-1865

HIGH POWER

Model	Internal Power Watts Max	Output Current (Cont.) Amps., Min	±Supply Range Volts Min/Max	Saturation @I_oMax (V_s-V_o) Volts, Max	Slew Rate V/µs Typ	V_{os} Initial mV Max	V_{os} vs Temp µV/°C Max	Bias Current nA Max	I_q mA Max	Gain BW Product MHz Typ	Current Limit (Amps)	Thermal Shutdown	Temp Range °C Min/Max
PA03	500	30	15/75	7	8	2	30	.05	300	1	Thermal	Yes	–25/85
PA03A	*	*	*	*	*	.5	10	.01	*	*	*	*	*
PA04	200	20	15/100	5.3/8.8(1)	50	10	50	.05	90	2	Ext Adj	No	–25/85
PA04A	*	*	*	*	*	5	30	.02	*	*	*	*	*
PA12	125	10	10/45	6	4	6	65	30	50	4	Ext Adj	No	–25/85
PA12A	*	15	10/50	7	*	3	40	20	*	*	*	*	–55/125
PA12M	*	*	10/45	6	*	6	65	30	*	*	*	*	*
PA12H		1	*	4		6		30	100		*	*	–25/200
PA61(2)	97	10	10/45	7	2.8	6	65	30	10	1	Ext Adj	No	–25/85
PA61A(2)	*	*	*	6	*	3	40	20	*	*	*	*	*
PA61M(2)	*	*	*	7	*	6	65	30	*	*	*	*	–55/125
PA51(2)	97	10	10/36	8	2.6	10	65	40	10	1	Ext Adj	No	–25/85
PA51A(2)	*	*	10/40	*	*	5	40	20	*	*	*	*	*
PA51M(2)	*	*	10/36	*	*	10	65	40	*	*	*	*	*
PA07	67	5	12/50	5	5	2	30	.05	30	1.3	Ext Adj	Yes	–25/85
PA07A	*	*	*	*	*	.5	10	.01	*	*	*	*	*
PA07M	*	*	*	*	*	2	30	.05	*	*	*	*	–55/125
PA10	67	5	10/45	8	5	6	65	30	30	6	Ext Adj	No	–25/85
PA10A	*	*	10/50	6	*	3	40	20	*	*	*	*	–55/125
PA10M	*	*	10/45	8	*	6	65	30	*	*	*	*	*
PA73(2)	67	5	10/30	8	2.6	10	65	40	5	1	Ext Adj	No	–25/85
PA73M(2)	*	*	*	*	*	*	*	*	*	*	*	*	–55/125
PA01	67	5	10/28	10	2.6	12	65	50	50	1	Ext Adj	No	–25/85
PA02	48	5	7/19	4	20	10	50	.2	37	4.5	Ext Adj	No	–25/85
PA02A	*	*	*	*	*	3	25	.1	*	*	*	*	–55/125
PA02M	*	*	*	*	*	10	50	.2	*	*	*	*	*
PA21	36	2.5	2.5/20	3.0	1.2	10	15 typ	1000	90	.6	(3)	Yes	–25/85
PA21A	*	3.0	*	3.5	*	4	10 typ	250	*	*	(4)	*	*
PA21M	*	2.5	*	3.0	*	10	15typ	1000	*	*	(3)	*	–55/125
PA25	36	2.5	2.5/25	3.0	1.2	10	15 typ	1000	90	.6	(3)	Yes	–25/85
PA25A	*	3.0	*	3.5	*	4	10typ	25	*	*	(4)	*	*
PB50	35	2	30/100	11	100	1750	7000	—	18	2.5	Ext Adj	No	–25/85
PB58	80	1.5	15/150	11	100	1500	7000	—	12	2.5	Ext Adj	No	–25/85
PB58A	*	2.0	*	*	*	1000	*	—	*	*	*	*	*

†Specifications apply for T_c = 25°C, unless otherwise stated. *Specification is same as above.

(1) 5.3 with Boost Voltage = V_s + 5V; 8.8 without Boost Voltage (2) Class "C" output—optimized for low cost—not recommended above 1KHz

DC-DC CONVERTERS

Model	Output Voltage Nom	Output Current Max	Output Power Max	Input Voltage I_o = Max	Output Ripple I_o = Max	Temp Range Min/Max	η Efficiency I_o = Max	Isolation 500Vdc
DB2805SA	5	4.00	20	16-50	50mV	–55/125	74	Yes
DB2812SA	12	1.88	22.5	14-50	40mV	–55/125	76	Yes
DB2815SA	15	1.508	22.5	15-50	40mV	–55/125	77	Yes

MONOLITHIC, HIGH VOLTAGE OPERATIONAL AMPLIFIER

PA41

CAPABLE OF 350V

APEX MICROTECHNOLOGY CORPORATION • TUCSON, ARIZONA • APPLICATIONS HOTLINE (800) 421-1865

FEATURES

- MONOLITHIC MOS TECHNOLOGY
- LOW COST
- HIGH VOLTAGE OPERATION — 350V
- LOW QUIESCENT CURRENT — 2mA
- NO SECOND BREAKDOWN
- HIGH OUTPUT CURRENT — 60 mA

APPLICATIONS

- PIEZO ELECTRIC POSITIONING
- ELECTROSTATIC TRANSDUCER & DEFLECTION
- DEFORMABLE MIRROR FOCUSING
- BIOCHEMISTRY STIMULATORS
- COMPUTER TO VACUUM TUBE INTERFACE

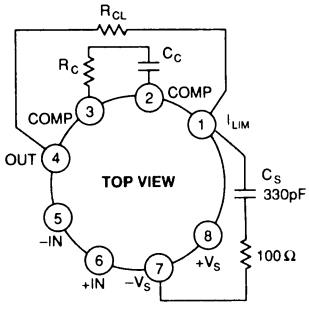
DESCRIPTION

The PA41 is a high voltage monolithic MOSFET operational amplifier achieving performance features previously found only in hybrid designs while increasing reliability. Inputs are protected from excessive common mode and differential mode voltages. The safe operating area (SOA) has no second breakdown limitations and can be observed with all type loads by choosing an appropriate current limiting resistor. External compensation provides the user flexibility in choosing optimum gain and bandwidth for the application.

The PA41 is hermetically sealed in a 8-pin TO-3 package, and all circuitry is isolated from the case by an aluminum nitride (AlN) substrate.

Apex Microtechnology

EXTERNAL CONNECTIONS



C_S, C_C ARE NPO RATED FOR FULL SUPPLY VOLTAGE.

$$R_{CL} = \frac{3}{I_{LIM}}$$

PHASE COMPENSATION

Gain	C_c	R_c
1	18pF	2.2KΩ
≥10	10pF	2.2KΩ
≥30	3.3pF	2.2KΩ

NOTE: Recommended mounting torque is 4-7 in•lbs (.45 -.79 N•m)

CAUTION: The use of compressible, thermally conductive insulators may void warranty.

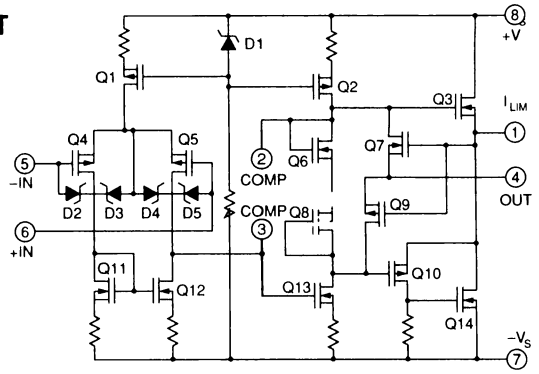
SPECIFICATIONS

PARAMETER	TEST CONDITIONS[1]	PA41 MIN	PA41 TYP	PA41 MAX	PA41A MIN	PA41A TYP	PA41A MAX	UNITS
INPUT								
OFFSET VOLTAGE, initial			35	60		15	30	mV
OFFSET VOLTAGE, vs. temp.[4]	Full temperature range		70	130		40	65	µV/°C
OFFSET VOLTAGE, vs supply			20	32		*	*	µV/V
OFFSET VOLTAGE, vs time			75			*		µV √kh
BIAS CURRENT, initial			5	50		*	*	pA
BIAS CURRENT, vs supply			.2	.5		*	*	pA/V
OFFSET CURRENT, initial			2.5	50		*	*	pA
INPUT IMPEDANCE, DC			10^{11}			*		Ω
INPUT CAPACITANCE			5			*		pF
COMMON MODE, voltage range		$\pm V_S$−12			*			V
COMMON MODE REJ., DC	V_{CM} = ±90V DC	84	94		*	*		dB
NOISE, broad band	10kHz BW, R_S = 1KΩ		50			*		µV RMS
NOISE, low frequency	1-10 Hz		110			*		µV p-p
GAIN								
OPEN LOOP at 15Hz	R_L = 5KΩ	94	106		*	*		dB
BANDWIDTH, open loop			1.6			*		MHz
POWER BANDWIDTH	C_C = 10pf, 280V p-p		26			*		kHz
PHASE MARGIN	Full temperature range		60			*		°
OUTPUT								
VOLTAGE SWING	I_O = 40mA	$\pm V_S$−12	$\pm V_S$−10		$\pm V_S$−10	$\pm V_S$−8.5		V
CURRENT, peak[5]		80			*			mA
CURRENT, continuous		60			*			mA
SETTLING TIME to .1%	C_C = 10pF, 10V step, A_V = −10		12			*		µs
SLEW RATE	C_C = OPEN		40			*		V/µs
CAPACITIVE LOAD	A_V = +1	10			*			nF
RESISTANCE[6], no load	R_{CL} = 0		150			*		Ω
RESISTANCE, 20mA load	R_{CL} = 0		25			*		Ω
POWER SUPPLY								
VOLTAGE[3]	See Note 3	±50	±150	±175	*	*	*	V
CURRENT, quiescent			1.6	2.0	.9	1.4	1.8	mA
THERMAL								
RESISTANCE, AC junction to case	F > 60Hz		5.4	6.5		*	*	°C/W
RESISTANCE, DC junction to case	F < 60Hz		9	10.4		*	*	°C/W
RESISTANCE, junction to air	Full temperature range		30			*		°C/W
TEMPERATURE RANGE, case	Meets full range specifications	−25		+85	*		*	°C

NOTES: * The specification for PA41A is identical to the specification for PA41 in applicable column to the left.
1. Unless otherwise noted T_C = 25°C, C_C = 18pF, R_C = 2.2KΩ. DC input specifications are ± value given. Power supply voltage is typical rating.
2. Long term operation at the maximum junction temperature will result in reduced product life. Derate internal power dissipation to achieve high MTTF. For guidance, refer to heatsink data sheet.
3. Derate maximum supply voltage .5 V/°C below case temperature of 25°C. No derating is needed above T_C = 25°C.
4. Sample tested by wafer to 95%.
5. Guaranteed but not tested.
6. The selected value of R_{CL} must be added to the values given for total output resistance.

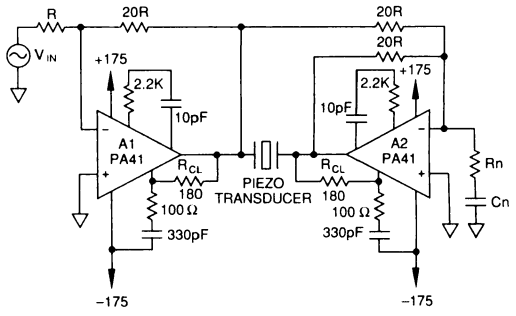
CAUTION The PA41 is constructed from MOSFET transistors. ESD handling procedures must be observed.

EQUIVALENT SCHEMATIC



TYPICAL APPLICATION

Low Cost
660 V p-p
Piezo Drive



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FEATURES

- **Advanced Packaging—JEDEC MO-127:**
  - **Low Internal Temperatures**
  - **Low Component Count**
  - **Withstands 5000g**
  - **Welded Hermetic Package**
  - **Remote Shutdown and Sense**
- **Full Output Power for T_{CASE} = -55° to +125°C (No Derating)**
- **Minimum Input Voltage As Low As 14 Volts**
- **High Power Density up to 22.5 W/in³**
- **High Isolation—500V**

DESCRIPTION

The DB2800 Series has been created to provide a reliable DC/DC Converter specified over the military temperature range. This has been achieved using a new package that is more advanced than other existing DC/DC Converter packages. A 12-pin MO-127 High Profile Power Dip™, pioneered by Apex for power amplifiers up to 500W, provides very low thermal gradients, rugged hermeticity and high voltage isolation.

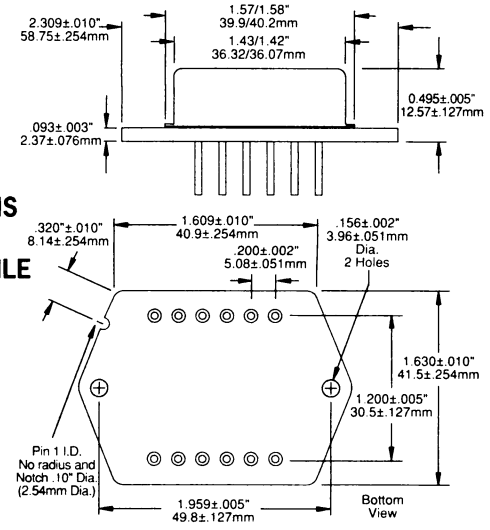
To further enhance reliability, the internal component count has been kept low. What is more, no tantalum or electrolytic capacitors are used in this design, a major cause of low MTBF in DC/DC Converters.

The sophisticated DB2800 Series features remote shutdown, kelvin sense, slaveability, and indefinite short circuit protection. It uses a push-pull topology operated in the feed forward, current mode. The typical switching frequency is 500 kHz. A π type input filter is included in order to reduce the peak to peak input ripple current.

This hybrid converter utilizes thick film (cermet) resistors, ceramic capacitors, miniature magnetics and semiconductor chips to maximize reliability, minimize size and give top performance. Ultrasonically bonded aluminum wires provide reliable interconnections at all operating temperatures.

The 12-pin MO-127 High Profile Power Dip™ package (see Package Outline) is hermetically sealed and isolated from the internal circuits. Do not use thermally conductive electrical insulators between package and heatsink.

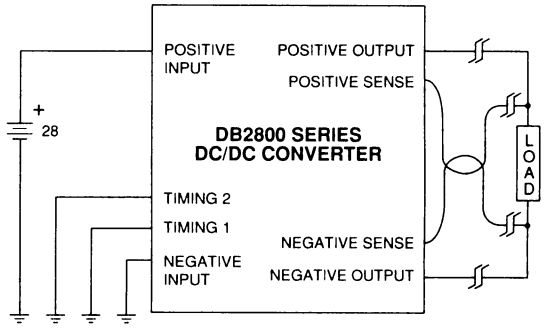
PACKAGE OUTLINE DIMENSIONS MO-127 HIGH PROFILE



MODEL/VOLTAGE CHART:

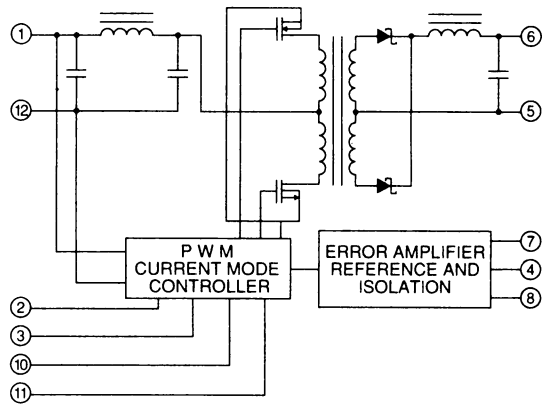
Model	Full Output Power Input Voltage Range	Output/Voltage Current
DB2805S DB2805SA	16-50 Volts	5 Volts/4.00 Amps
DB2812S DB2812SA	14-50 Volts	12 Volts/1.88 Amps
DB2815S DB2815SA	15-50 Volts	15 Volts/1.50 Amps

TYPICAL APPLICATION

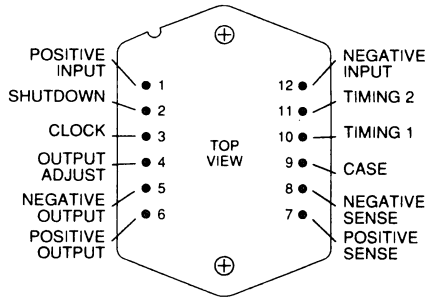


The above diagram shows the remote sense feature which reduces V_O errors due to resistive drops in long power supply lines. This diagram also shows the connection for non-synchronized operation.

BLOCK DIAGRAM



EXTERNAL CONNECTIONS



Apex Microtechnology

Digital Signal Processing: The DaSP/PaC Chipset

Features of the Digital array Signal Processor (DaSP)

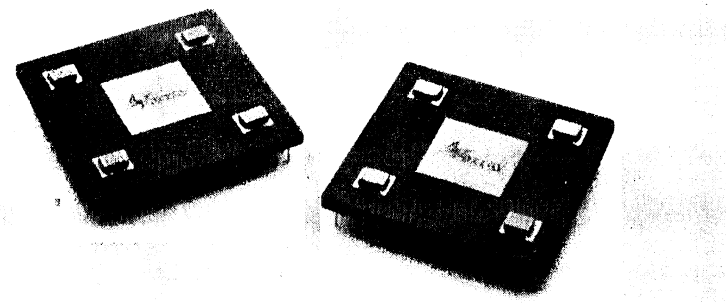
- Arithmetic throughput of up to 400 MOPS
- Processes 16-bit real or 32-bit complex integer arrays
- 16 FFT specific and general purpose array processing functions
- 16 to 20 bit fixed point arithmetic with full block floating point support for FFT functions
- Internal conjugation capability allows IFFT with no additional time expenditures
- 144 and 269 pin PGA package
- 2-3W typical power dissipation

Features of the Programmable array Controller (PaC)

- Full address generation capability for radix-2, radix-4, and mixed radix-2/radix-4 FFTs of up to 64K complex or 128K real points
- Simultaneously generates up to five 16 bit addresses to both I/O buffer and data processing memories to permit full overlapping and synchronization of I/O transfers with data processing
- Overlap/discard address generation for supporting real-time frequency domain FIR filtering
- 32 word instruction store for holding DSP program
- 144 and 180 pin PGA package
- 2-3W typical power dissipation

Applications:

- Radar
- Sonar
- EW/ECM
- Digital Radio
- Test Instruments
- Medical Instruments
- Spectrum Analyzers
- Transmultiplexing
- Image Processing
- Image Compression
- Image Reconstruction
- Spread Spectrum Communications



Array Microsystems

Description:

The a66110/a66111 DaSP combines arrays of adders, multipliers, and arithmetic logic units (ALUs) on a single integrated circuit, and performs high-level DSP and general-purpose operation on real and complex arrays of data. It simultaneously processes 16, 16-bit real values (or 8 complex values) and produces 8, 16-bit real values (or 4 complex values) every pipeline cycle. At maximum clock rate, arithmetic throughput is 400 MOPS with a data I/O rate of 4 billion bits per second.

The DaSP provides 16 FFT-specific and general-purpose instructions including radix-2 and radix-4 decimation-in-frequency FFT butterflies, complex multiply, real multiply, and ALU and logic operations. Included are special instructions which can almost double the chip's performance when executing FFTs on real data. The DaSP's two interface options, dual and quad mode, offer trade-offs in memory access requirements and system complexity. For example, the quad mode trades off a more complicated memory design for relaxed memory access time, while the dual mode results in a simpler memory design using faster memory. In addition, the dual mode offers bidirectional I/O ports which simplify the design of recursive systems.

The a66210/a66211 PaC provides total system control and addressing for FFT-based DSP systems, controlling I/O, external memory, and the DaSP. Combined with off-the-shelf static random access memory (SRAM), the DaSP and PaC chipset provides a compact, complete, easily-designed DSP system solution.

Benchmarks

	25 MHz	40 MHz
64 Point FFT		
Real	7.2 µs	4.5 µs
Complex	10.9 µs	6.8 µs
1024 Point FFT		
Real	125.9 µs	78.7 µs
Complex	209.9 µs	131.2 µs
32K Point FFT		
Real	5.90 ms	3.69 ms
Complex	10.49 ms	6.56 ms
64K Point FFT		
Real	11.80 ms	7.38 ms
Complex	20.98 ms	13.11 ms
2048 Tap FIR Filter Dual Channel Real or Single Channel Complex (12.5% overlap)	1.46 MHz Max Rate/ Channel	2.33 MHz Max Rate/ Channel

The PaC integrates five address generators and a 20-bit wide instruction memory that defines the user's algorithm. The PaC directly supports up to 64K-point complex (or 128K-point real) data frames, and supports unlimited program sizes with optional external memory. An existing DaSP/PaC-based system design can be easily modified to accommodate larger FFTs by simply increasing memory size.

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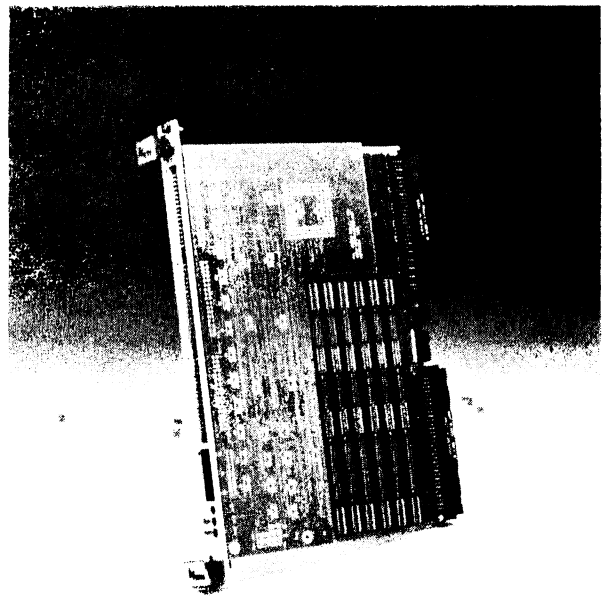
400 MOPS DSP Engine for Industry-Standard VMEbus:
The a66540 Frequency Domain array Processors (FDaPs)

Features:

- Configurable as coprocessor on VMEbus
- Fits in single slot; standard double Eurocard 6U format
- Available in three memory configurations and two speed options: 4K, 16K, 64K at 25 MHz or 40 MHz
- Supports data windowing, magnitude/phase, and FFT pre- and post-processing
- Features fully-buffered I/O for real-time continuous operation
- Internal conjugation capability allows IFFT with no additional time expenditures
- Features 20 MHz I/O port on top-mounted ribbon cable connectors
- Compatible with VMEbus on P1/P2; supports D16, D32, and BLT transfers
- Add on Daughter Cards provide many different high-speed I/O options (including cascade architectures)



Applications:

- Digital filtering
- Spectral analysis
- Transmultiplexing
- Test instrumentation
- Medical instrumentation
- Radar/sonar processing
- Frequency domain coprocessing
- Image processing/machine vision
- Image compression/reconstruction
- Spread spectrum/secure communications

Description:

The a66540, a 40 MHz FDaP compatible with 6U by 160 mm VMEbus systems, accommodates up to 64K-point complex (8K- to 128K-point real) fast Fourier transforms (FFTs).

The a66540 board performs 400 million operations per second and is optimized for frequency domain processing such as FFTs and finite impulse response (FIR) filters using fast convolution. The FDaP operates from a single 5-volt power supply and typically consumes less than 35 watts.

In addition to standard array processing functions such as add, subtract, and multiply operations, the a66540 board can perform a radix-4 decimation in frequency butterfly in as little as 100 ns. This capability enables the FDaP to perform a 1K complex point FFT or inverse FFT in 132.5 µs.

The FDaP features a private high-speed data I/O bus and extensive double buffering for continuous processing of real-time data. Input and output is normally provided via high speed front panel I/O connectors on an add-on Daughter Card. For example, the a66541 Daughter Card allow simultaneous input and output of 32-bit complex data to the a66540 at rates near 20 MHz. Likewise, the a66542 allows collection of real data via high speed front panel connectors. Daughter Cards allow the user the adapt to many different I/O protocols while still using only one VME slot.

Since it uses the DaSP/PaC chipset, the a66540 can be easily programmed with several high-level vector instructions to execute any FFT up to the maximum array size. On-board program storage (2K words) and input/output FIFOs provide the capability of continuous processing and fast switching between different DSP algorithms.

a66540 *Board Dimensions:*

SU-6 Eurocard	160mm x 233.35mm

Benchmarks

	a66540 25 MHz	a66540 40 MHz
64 Point FFT		
Real	8.2 µs	5.1 µs
Complex	7.97 µs	4.98 µs
1024 Point FFT		
Real	127.4 µs	79.6 µs
Complex	212.3 µs	132.7 µs
32K Point FFT		
Real	5.90 ms	3.69 ms
Complex	10.50 ms	6.56 ms
64K Point FFT		
Real	11.80 ms	7.38 ms
Complex	20.98 ms	13.11 ms

Array Microsystems

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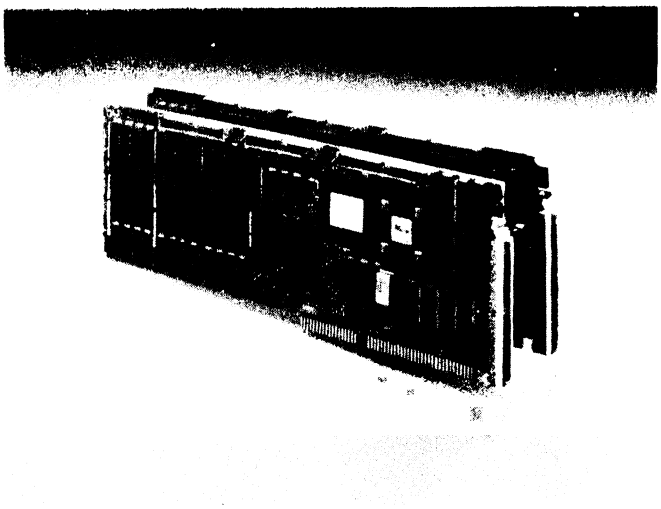
250 MOPS DSP Engine for 16-bit PC•AT ISAbus:
The a66550 Frequency Domain array Processor (FDaP)

Features:

- Fully memory mapped to PC-AT bus
- Processes frequency domain FIR filters up to 8192 taps
- Supports data windowing and magnitude-squared FFT pre- and post-processing
- Features fully-buffered I/O for real-time continuous operation
- Uses block floating point arithmetic for optimum dynamic range and signal-to-noise performance
- Accommodates real-time I/Q-to-magnitude/phase output conversion option
- Internal conjugation capability allows IFFT with no additional time expenditures
- Includes 10 MHz I/O back panel connectors
- Available in two memory configurations: a66550/8K--processes up to 8K complex point or 16K real point arrays a66550/32K--processes up to 32K complex point or 64K real point arrays



Applications:

- Digital radio
- Digital filtering
- Spectral analysis
- Transmultiplexing
- Test instrumentation
- Medical instrumentation
- Radar/sonar processing
- Frequency domain coprocessing
- Image processing/machine vision
- Image compression/reconstruction
- Spread spectrum/secure communications

a66550 *Board Dimensions:*

Standard IBM PC-AT size, 13.130 inches long x 4.500 inches high

Description:

The a66550 brings high performance FFT processing to any PC-AT compatible computer. Performing up to 250 MOPS, it is optimized for frequency domain processing such as fast Fourier transforms (FFTs) and finite impulse response (FIR) filters using fast convolution. The FDaP operates from the PC-AT bus 5-volt power supply, and typically consumes less than 35 watts.

The two board set will fit into two full size PC-AT slots and will operate on the 16 bit PC-AT (ISA) bus. The boardset allows real or complex input from either the high speed connectors on the back panel or from the PC-AT bus. In both cases, the system can operate in real time with its fully double buffered configuration. The FDaP accommodates an optional complex I-and-Q to magnitude-and-phase converter for post-FFT processing.

The a66550 is available in two memory configurations. The a66550/8K processes complex FFTs up to 8K points and real FFTs up to 16K points; the a66550/32K board handles complex FFTs up to 32K points and real FFTs up to 64K points.

The a66550's unsurpassed performance is provided by array Microsystems' a66111 Digital array Signal Processor and a66211 Programmable array Controller both operating at 25 MHz. These devices provide the horsepower to compute a radix-4 butterfly in as little as 160 ns, and can deliver a 1024 point FFT in just 210 µs. Control software is provided with every boardset, which allows the user to take advantage of the a66550's simple programmability.

Benchmarks

	a66550 25 MHz
64 Point FFT	
Real	7.2 µs
Complex	10.9 µs
1024 Point FFT	
Real	125.9 µs
Complex	209.9 µs
32K Point FFT	
Real	5.90 ms
Complex	10.49 ms
64K Point FFT	
Real	15.73 ms
Complex	----
2048 Tap FIR Filter Dual Channel Real or Single Channel Complex (12.5% Overlap)	1.46 MHz Max Rate/ Channel

Array Microsystems

1420 Quail Lake Loop, Colorado Springs, CO 80906 • (719) 540-7999 • FAX (719) 540-7950

arraysof_t SM

Completing the Total System Solution: Application Tools & Development Environment

arraysof_t is a complete DSP software development system supporting array Microsystems' a66 family of Frequency Domain array Processors.

arraysof_t provides a menu driven user interface allowing easy access to a suite of powerful development tools at the click of a mouse.

arraysof_t Development System Features:

- DaSP/PaC code generator
- DaSP/PaC assembler
- DaSP/PaC disassembler
- Window generator
- Full DaSP/PaC program control
- On-screen display of data
- Board-level diagnostics

The DaSP/PaC code generator provides the user with simple menu selections to generate code for a specific function such as an FFT or a digital filter. For example, to create a program to perform a windowed, 4096 point complex FFT:

- Select "Generate Program"
- Select "FFT"
- Select array size of "4096"
- Select "Window"
- Enter file name

The assembly language MNEUMONICS to perform a windowed, 4096 point complex FFT will be generated. The code generated is in ASCII format and is saved to disk under a user-entered file name.

The DaSP/PaC assembler generates the machine code required to run the DaSP/PaC. The assembler accepts as input an ASCII file containing the assembly language MNEUMONICS generated by the DaSP/PaC code generator or a user-written assembly language MNEUMONICS file. The output from the assembler is saved to disk. The code can be saved in a variety of formats including JEDEC, INTEL HEX, and Motorola S.

The DaSP/PaC disassembler converts DaSP/PaC machine code into DaSP/PaC assembly language MNEUMONICS. The disassembler will accept input from a disk file or from the program in the PaC.

The window generator will calculate the window coefficients for various types of windows. For example, to create a 4096 point Harris-Blackman window:

- Select "Generate Window"
- Select "Harris-Blackman"
- Select array size of "4096"
- Enter file name

A 4096 point Harris-Blackman window is generated is saved to disk under a user entered file name.

Full DaSP/PaC program control is provided by arraysof_t . All the functions to upload DaSP/PaC programs and data to the array processor and control the execution of the programs are provided. This control includes:

- Load DaSP/PaC program from disk file
- Load/Save data to/from any board memory from/to a disk file
- Run DaSP/PaC program (Continuous, Single Step, Breakpoint)
- Stop/Reset program

The on-screen display allows the user to display data from any of the memories in graphs on the monitor. The data can be displayed in various formats including real/imaginary or magnitude/phase, both linear and logrithmic (dB).

The hardware diagnostics provides the user with the capability to quickly and easily determine that the array processor is functioning properly. Information provided by these tests will also aid array Microsystems' applications engineers solve the problem should the card malfunction.

Array Microsystems

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ATT3000 Series Field-Programmable Gate Arrays

FEATURES

- High Performance—up to 125 MHz Toggle Rates
- Second Generation User-Programmable Gate Array
  - I/O functions
  - Digital logic functions
  - Interconnections
- Flexible array architecture
  - Compatible arrays, 2000 to 9000 gate logic complexity
  - Extensive register and I/O capabilities
  - High fan-out signal distribution
  - Internal three-state bus capabilities
  - TTL or CMOS input thresholds
  - On-chip oscillator amplifier
- Standard product availability
  - Low-power, CMOS, static memory technology
  - Pin-for-Pin to *Xilinx** XC3000 Family
  - 100% factory pre-tested
  - Selectable configuration modes
- Complete *XACT** development system
  - Schematic Capture
  - Automatic Place/Route
  - Logic and Timing Simulation
  - Design Editor
  - Library and User Macros
  - Timing Calculator
  - Standard PROM File Interface

DESCRIPTION

The CMOS ATT3000 Series Field-Programmable Gate Array (FPGA) family provides a group of high-performance, high-density, digital, integrated circuits. Their regular, extendable, flexible, user-programmable array architecture is composed of a configuration program store plus three types of configurable elements: a perimeter of I/O Blocks, a core array of Logic Blocks, and resources for interconnection. The *XACT* development system provides schematic capture and auto place-and-route for design entry. Logic and timing simulation, and in-circuit emulation are available as design verification alternatives. The design editor is used for interactive design optimization, and to compile the data pattern which represents the configuration program.

The FPGA's user logic functions and interconnections are determined by the configuration program data stored in internal static memory cells. The program can be loaded in any of several modes to accommodate various system requirements. The program data resides externally in an EEPROM, EPROM, or ROM on the application circuit board, or on a floppy disk or hard disk. On-chip initialization logic provides for optional automatic loading of program data at powerup. A serial configuration PROM can provide a very simple serial configuration program storage.

Basic Array	Logic Capacity (usable gates)	Configurable Logic Blocks	User I/Os	Program Data (bits)
ATT3020	2000	64	64	14779
ATT3030	3000	100	80	22176
ATT3042	4200	144	96	30784
ATT3064	6400	224	120	46064
ATT3090	9000	320	144	64160

The ATT3000 Series FPGAs are an enhanced family of Field Programmable Gate Arrays, which provide a variety of logic capacities, package styles, temperature ranges, and speed grades.

ATT3000 Series Field-Programmable Gate Arrays Product Availability

		44 Pin	68 Pin	84 Pin		100 Pin		132 Pin		160 Pin	164 Pin	175 Pin	
		Plastic PLCC	Plastic PLCC	Plastic PLCC	Ceramic PGA	Plastic QFP	Ceramic QFP	Plastic PGA	Ceramic PGA	Plastic QFP	Ceramic QFP	Plastic PGA	Ceramic PGA
		M44	M68	M84	R84	J100	N100	H132	R132	J160	N164	H175	R175
ATT3020	—70		CI	CI	CI	CI	C						
	—100		CI	CI	CI	CI	C						
	—125		C	C	C	C	C						
ATT3030	—70	CI	CI	CI	CI	CI							
	—100	CI	CI	CI	CI	CI							
	—125	C	C	C	C	C							
ATT3042	—70			CI	CI	CI	C	CI	CI				
	—100			CI	CI	CI	C	CI	CI				
	—125			C	C	C	C	C	C				
ATT3064	—70			C				CI	CI	C			
	—100			C				CI	CI	C			
	—125			C				C	C	C			
ATT3090	—70			C						CI	CI	CI	CI
	—100			C						CI	CI	CI	CI
	—125			C						C	C	C	C

Notes: C indicates commercial temperature option.
I indicates industrial temperature option.

Xilinx and *XACT* are trademarks of Xilinx, Inc.

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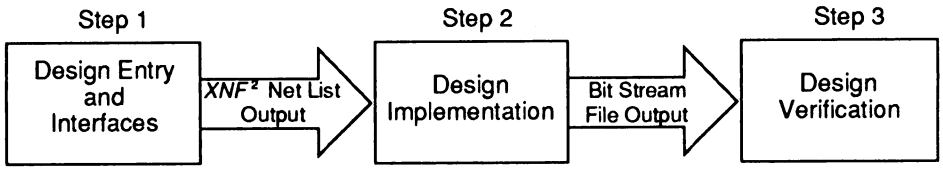
❑ AT&T Microelectronics, Dept. 52AL040420, 555 Union Boulevard, Allentown, PA 18103 **1-800-372-2447** (In Canada, **1-800-553-2448**)

AT&T ATT3000 Series Field-Programmable Gate Arrays

AT&T Design Flow



Step 1	Step 2	Step 3
ATT-DS 31-PC1	ATT-DS 501-PC1	ATT-DS 22-PC1
ATT-DS 310-PC1	ATT-DS 501-AP1	ATT-DS 290-PC1
ATT-DS 35-PC1	ATT-DS 501-SN1	ATT-DS 295-SN2
ATT-DS 343-AP1	ATT-DS 501-SN2	
ATT-DS 390-PC1		
ATT-DS 391-PC1		
ATT-DS 391-SN1		
ATT-DS 391-SN2		

AT&T FPGA Design Kits

Design Entry and Interfaces

ATT-DS 31-PC1	*FutureNet DASH*[1] *XNF*[2] Interface & TTL Library
ATT-DS 310-PC1	*FutureNet DASH-LCA*[2] Schematic Editor, *XNF* Interface, & TTL Library
ATT-DS 35-PC1	Schematic Interface for *OrCad*[3] SDT Schematic Editor
ATT-DS 343-AP1	Schematic and Simulator Interface for *Mentor Graphics*[4] *Apollo*[5] Workstation
ATT-DS 390-PC1	*Viewdraw*[6] *-LCA* Schematic Editor, *XNF* Interface, and TTL Library
ATT-DS 391-PC1	PC *XNF* Interface & Library for *Viewlogic*[6] *Viewdraw* & *Viewsim*[6]
ATT-DS 391-SN1	*Sun3*[7] *XNF* Interface & Library for *Viewlogic Viewdraw* & *Viewsim*
ATT-DS 391-SN2	*Sun4*[7] *XNF* Interface & Library for *Viewlogic Viewdraw* & *Viewsim*

Design Implementation

ATT-DS 501-PC1	Design Implementation System — PC Based
ATT-DS 501-AP1	Design Implementation System for *Apollo*
ATT-DS 501-SN1	Design Implementation System for *Sun3*
ATT-DS 501-SN2	Design Implementation System for *Sun4*

Design Verification

ATT-DS 290-PC1	*Viewsim* Simulator with *XNF* Timing Delay Interface
ATT-DS 22-PC1	Simulator (*SILOS*[8] 16K Gate) and Timing Delay Interface
ATT-DS 295-SN2	*Sun4 Viewdraw-LCA*, *Viewsim*, *Viewwave*[6] with *XNF* Interface and Library

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2. *LCA* and *XNF* are trademarks of Xilinx, Inc.
3. *OrCAD* is a registered trademark of OrCAD Systems Corp.
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AT&T Microelectronics

AT&T Mass Storage — Read Channel
ATT91C010 Low-Power REACH1 Device

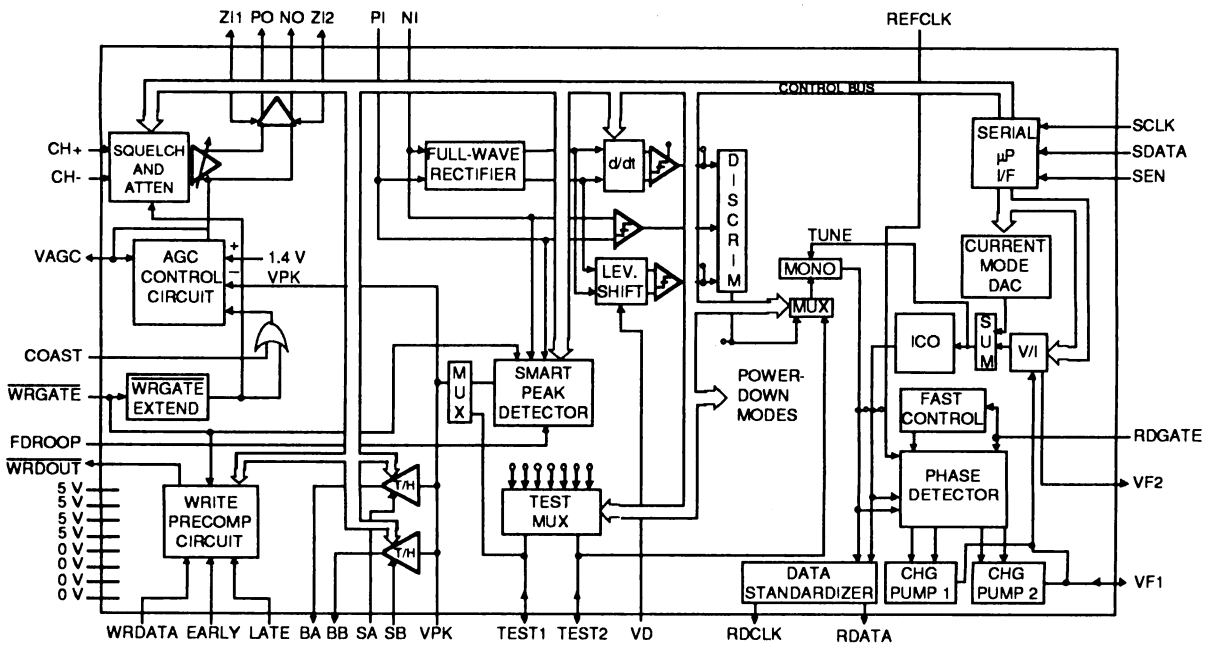
Features

- Fully integrated single-chip read channel
- 5 V only all CMOS design
- Low-power operation: 225 mW max read mode/ 255 mW max write mode
- Standby mode power = 25 mW
- Data rates up to 30 Mbits/s
- Internal embedded servo demodulator
- On-chip pulse detector & AGC circuitry
- Fully integrated multizone constant density recording support
- On-chip DAC for PLL center frequency control
- Fast-acquisition zero-phase start PLL
- On-chip write precompensation circuitry
- µP programmable via serial interface
- Available in both 44-pin PLCC package and EIAJ PQFP package

Description

The ATT91C010 all CMOS Read Channel Device (REACH1) has been designed specifically for low-power, small form factor Winchester rigid disk drives. The REACH1 consists of an automatic gain control (AGC) circuit, peak detector, pulse detector, embedded servo demodulator, write precompensation circuit, and data synchronizer. An on-chip current mode, DAC, permits accurate tuning of the data PLL's center frequency to facilitate the use of constant density recording techniques used to increase disk platter capacity.

The REACH1 is fabricated in AT&T's advanced 0.9 µm, mixed analog/digital CMOS process. In operation, the device dissipates less than 225 mW (read mode) or 255 mW (write mode) from a single 5 V supply. In powerdown standby mode, the power consumption decreases to under 25 mW.



Note: ⚲ = TEST MUX INPUT

REACH1 Block Diagram

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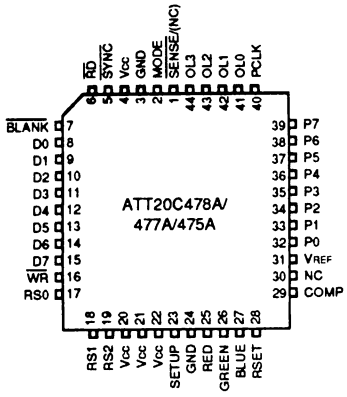
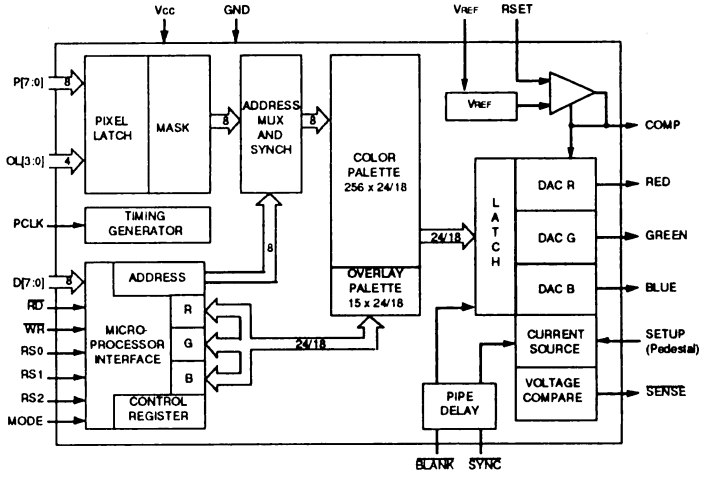
AT&T Microelectronics

CMOS RAMDACs Selection Table

Part Number	Application	Voltage Reference	Monitor Detection	Power-Down	Overlay Colors	Speeds (MHz)
ATT20C475A	Portable 6-bit	Int/Ext	Yes	Yes	15	110/100/80/66
ATT20C476A	Desktop, 6-bit	Int/Ext	Yes	No	N/A	110/100/80/66
ATT20C477A	Portable 8-bit	Int/Ext	Yes	Yes	15	110/100/80/66
ATT20C478A	Desktop, 8-bit	Int/Ext	No	No	15	110/100/80/66
ATT20C458	Workstation, 8-bit	Int/Ext	No	No	4	200/170/125
ATT20C491	True color, 8-bit	Int/Ext	Yes	Yes	15	110/100/80/66
ATT20C492	True color, 6-bit	Int/Ext	Yes	Yes	15	110/100/80/66

ATT20C47XA CMOS RAMDACs





Features

- 110/100/80/66 MHz operation
- Low power dissipation (0.5 W Typ)
- Powerdown to ≤3 mA typical (ATT20C477A)
- Internal V_{REF} accuracy better than ±3%
- External V_{REF} option
- Antisparkle circuitry
- Automatic external V_{REF} disable during powerdown (ATT20C477A/475A)
- Programmable blank pedestal
- Industry-compatible footprint
- 24-/16-/15-bit true color
- 8-bit pseudo color
- 24-/16-/15-bit true color bypass

Description

The ATT20C47XA RAMDACs are designed to increase speed and reduce power required for the digital-to-analog conversion of frame buffer images.

All devices contain antisparkle circuitry that prevents noise on the screen during palette updates. On-chip output comparators detect connection to a monitor eliminating the need for an external comparator. An internal voltage reference with better than ±3% accuracy helps your product meet PC graphics requirements and eliminates the need for external references.

The devices are fabricated in AT&T's 0.9 µm CMOS process, adding performance and speed to industry-standard capabilities. CMOS design and unique RAM cell structure results in the lowest power dissipation as compared to the industry leader.

These devices are offered in the industry-standard 44-pin PLCC packages and compatible footprints. They are meant to work with a voltage reference only (internal or external).

For additional information, contact your AT&T Account Manager or the following:
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AT&T Microelectronics

ATT20C458 CMOS RAMDAC

Features

- 200/170/125 MHz operation
- Power dissipation = 1.1 W at 125 MHz, 1.3 W at 200 MHz
- 84-pin, PLCC
- 5:1, 4:1, or 1:1 multiplexed pixel input
- *VGA** support with the 1:1 MUX mode
- Internal V_{REF} accuracy better than ±3%
- 256 x 24 dual-port color RAM
- Four-color overlay RAM
- Standard MPU Interface
- RS-343A compatibie outputs
- Monolithic 0.9 µm CMOS
- Single +5 V power supply

Description

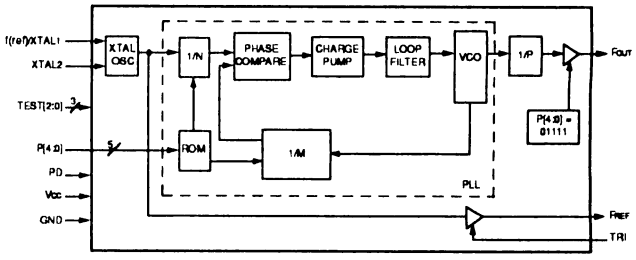
The ATT20C458 is a high-speed monolithic +5 V CMOS RAMDAC for high-resolution computer graphics. A 1:1 MUX mode supports super *VGA* graphics up to 80 MHz. High-speed versions (200 MHz) support 2K x 1500 screen resolutions with 256 displayable colors from a palette of 16.8 million.

AT&T fabricates the part in 0.9 µm CMOS for low power dissipation and faster pixel rates. A 5:1 multiplexed pixel port driven at 40 MHz provides the input to a 200 MHz part. An internal voltage reference eliminates the need for an external reference. This reduces power dissipation, part count, and board space. An external voltage reference can be used if desired. The part is offered in an 84-pin PLCC package.

ATT20C200 CMOS Frequency Synthesizer

Features

- 14.318 MHz clock or crystal input
- Output:
  - — Pixel clock frequencies up to 80 MHz
  - — Reference frequency 3-state output 14.318 MHz
- Internal loop filter eliminates external components
- Advanced PLL for low phase jitter (1% rms)
- Replaces multiple crystals in graphics subsystems
- 3-statable clock output
- Monotonic frequency transitions
- Up to 32 selectable frequencies
- Powers down to <1 mA
- Power dissipation <125 mW
- Monolithic, 0.9 µm CMOS
- 20-pin DIP package



Description

The ATT20C200 Clock Synthesizer replaces multiple crystals on graphic cards and subsystems. It generates up to 32 frequencies selectable on the P[4:0] inputs. A single signal drives the frequency input. This can be the standard 14.318 MHz PC system bus clock or a 14.318 MHz crystal. The input frequency is channeled to an output pin through a 3-statable output.

The device has an on-chip loop filter. This eliminates the need for external loop filter components.

The powerdown pin shuts down the operation of the device. This is useful for low-power applications such as laptop and notebook systems.

* *VGA* is a trademark of International Business Machine Corporation.

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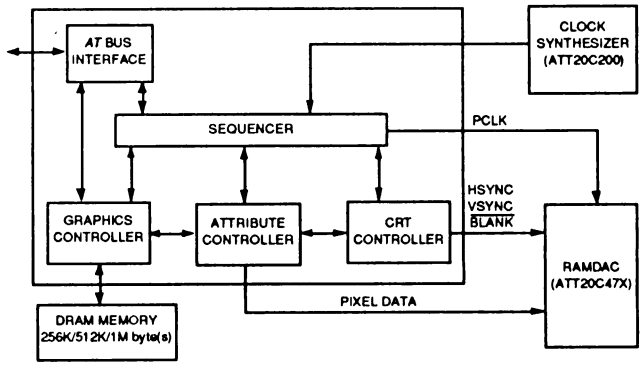
❑ AT&T Microelectronics, Dept. 52AL040420, 555 Union Boulevard, Allentown, PA 18103 **1-800-372-2447** (In Canada, **1-800-553-2448**)

CMOS Super *VGA*[1] Graphics Controller: ATT20C101

Features

- ATT20C101 is a single-chip video graphics controller for *IBM PC/XT/AT*[1], and *MCGA*[1] compatible systems
- 640 x 480 with 16.8M colors
- Local bus support for 386SX, 386DX, and 486
- Fully *IBM VGA* register compatible
- Fully backward compatible with *IBM EGA*[1], *CGA*[1], *MDA*[1], and *Hercules*[2]
- Supports high-resolution modes such as:
  — 800 x 600, 16 colors (VESA compatible)
  — 800 x 600, 256 colors
  — 1024 x 768, 16 colors
  (interlaced and noninterlaced)
  — 132 column, 60 rows
- 70 Hz refresh for all 16 color modes
- 72 MHz maximum pixel clock
- Flexible memory interface supports:
  — 64K x 4 DRAMs (8 or 16)
  — 64K x 16 DRAMs (2 or 4)
  — 256K x 4 DRAMs (8)
  — 256K x 16 DRAMs (2)
- Page mode memory control logic for higher-speed performance
- On-chip write-FIFO for CPU bus interface
- Auto bus width sensing
- Auto monitor detect
- Operates with oscillators or clock synthesizer chip
- No additional components needed for feature connector
- 0.9 µm CMOS
- 132-pin JEDEC plastic quad flat pack



Description

The ATT20C101 Super *VGA* is the first offering in AT&T's line of AT&T Graphics Controllers. It offers high-speed graphics subsystem solutions with as few as five additional components. A 16-bit add-in card needs only the ATT20C101, a RAMDAC (ATT20C476A), a clock synthesizer (ATT20C200), memory, and two TTL buffers.

The ATT20C101 device is a one-chip implementation of the logic needed to support the Super *VGA* graphics standard. The ATT20C101 device implements five functions of the graphics subsystem: the CRT, graphics and attribute controllers, the timing sequencer, and miscellaneous logic. The ATT20C101 device's advanced memory control logic and its two-stage FIFO allow high-speed operation, typically three to four times faster than the original *VGA* card.*

The ATT20C101 Graphics Controller offers hardware register compatibility with *VGA*, *EGA*, *CGA*, *MCGA*, *Hercules*, and *MDA* standards, and supports enhanced modes such as 800 x 600, 256 colors and 1024 x 768, 16 colors.

Evaluation boards and manufacturing kits are available. Drivers for high-resolution modes are provided for *Microsoft Windows*[3] and other popular applications.

* Based upon *PC Magazine* benchmark 5.0.

1. *VGA*, *IBM*, *PC*, *XT*, *AT*, *EGA*, *CGA*, *MCGA*, and *MDA* are trademarks of International Business Machine Corporation.
2. *Hercules* is a trademark of Hercules Corporation.
3. *Microsoft Windows* is a registered trademark of Microsoft Corporation.

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AT&T Microelectronics

ATT7C106 High-Speed CMOS SRAM
1 Mbit (256K x 4)

Features

- High speed —15 ns maximum access time
- Advanced CMOS technology
- Low-power operation
  - — Active: 635 mW maximum at 25 ns
  - — Standby (typical): 110 mW (TTL inputs); 11 mW (CMOS inputs)
- Automatic powerdown
- TTL-compatible inputs and outputs
- Data retention at 2 V for battery backup operation
- Package styles available:
  - — 28-pin, plastic DIP
  - — 28-pin, plastic SOJ

Description

The ATT7C106 device is a high-performance, low-power CMOS static RAM organized as 262,144 words by 4 bits per word. The data-in and data-out signals share I/O pins. The ATT7C106 has an active-low chip enable and a separate output enable. This device is available in three speeds with maximum access times from 15 ns to 25 ns.

Inputs and output are TTL compatible. Operation is from a single 5 V power supply. Power consumption is 635 mW (maximum) at 25 ns cycle time.

Dissipation drops to 110 mW (typical) when the memory is deselected (enable is high).

Data can be retained in inactive storage with a supply voltage as low as 2 V. The ATT7C106 consumes only 1.5 mW (typical) at 3 V, allowing effective battery backup operation.

Pin Information

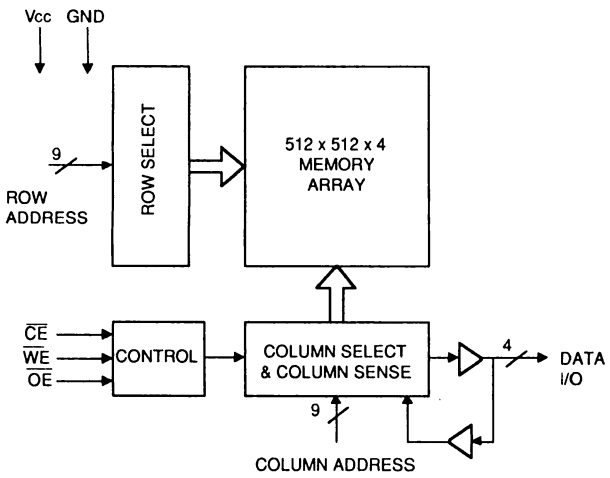

Figure 1. Block Diagram

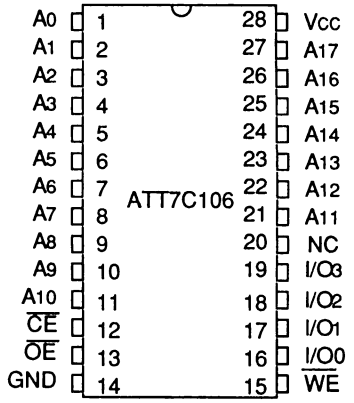

Figure 2. Pin Diagram

Table 1. Pin Descriptions

Pin	Name/Function
A0—A17	Address Inputs
I/O0-I/O3	Data Input/Output
$\overline{CE}$	Chip Enable
$\overline{OE}$	Output Enable
$\overline{WE}$	Write Enable
GND	Ground
Vcc	+5 V Supply
NC	No Connection

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AT&T Microelectronics

ATT7C107 High-Speed CMOS SRAM
1 Mbit (1 Mbit x 1)

Features

- 15 ns maximum access time
- 1Mbit by 1 Static RAM with separate I/O, chip select powerdown
- Automatic powerdown
- Advanced CMOS technology
- Low-power operation
  —Active: 635 mW maximum at 25 ns
  —Standby (typical): 110 mW (TTL inputs); 11 mW (CMOS inputs)
- Data retention at 2 V for battery backup operation
- Package styles available:
  —28-pin, plastic DIP
  —28-pin, plastic SOJ

Description

The ATT7C107 device is a high-performance, low-power CMOS static RAM organized as 1,048,576 words by 1 bit. The data-in and data-out signals share I/O pins. This device is available in three speeds with maximum access times from 15 ns to 25 ns.

Operation is from a single 5 V power supply and all interface signals are TTL compatible. Power consumption is 635 mW (typical) at 25 ns.

Dissipation drops to 100 mW (typical) when the memory is deselected (enable is high).

In addition, data can be retained in inactive storage with a supply voltage as low as 2 V. The ATT7C107 consumes only 1.5 mW (typical) at 3 V, allowing effective battery backup operation.

Pin Information

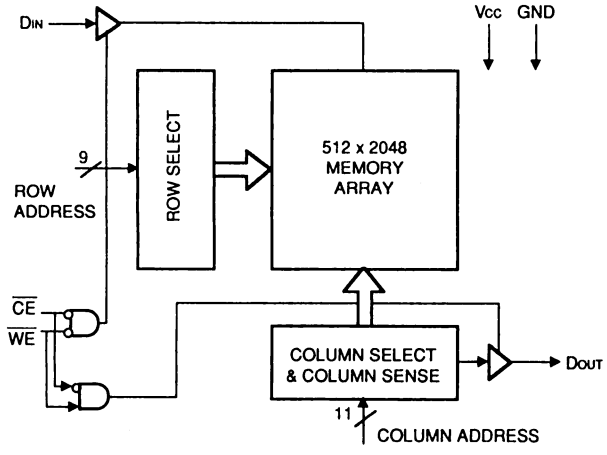

Figure 1. Block Diagram

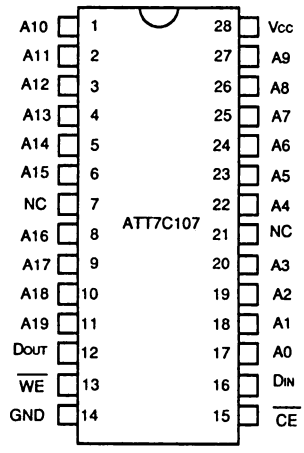

Figure 2. Pin Diagram

Table 1. Pin Descriptions

Pin	Name/Function
A0—A19	Address Inputs
DIN/DOUT	Data Input/Output
$\overline{CE}$	Chip Enable
$\overline{WE}$	Write Enable
GND	Ground
Vcc	+5 V Supply
NC	No Connection

For additional information, contact your AT&T Account Manager or the following:
❑ AT&T Microelectronics, Dept. 52AL040420, 555 Union Boulevard, Allentown, PA 18103 **1-800-372-2447** (In Canada, **1-800-553-2448**)

ATT7C108/109 High-Speed CMOS SRAM
1 Mbit (128 Kbit x 8)

Features

- High speed —15 ns maximum access time
- Easy memory expansion with $\overline{CE1}$, CE2, and $\overline{OE}$ options
- Automatic powerdown
- Low-power operation
  - — Active: 880 mW maximum at 25 ns
  - — Standby (typical): 110 mW (TTL inputs); 14 mW (CMOS inputs)
- TTL-compatible inputs and outputs
- Data retention at 2 V for battery backup operation
- Package styles available:
  - — 32-pin, plastic DIP
  - — 32-pin, plastic SOJ

Description

The ATT7C108 and ATT7C109 devices are high-performance, low-power CMOS static RAMs organized as 131,072 words by 8 bits per word. The eight data-in and data-out signals share I/O pins. The ATT7C108 and 109 differ in that the ATT7C108 has a single chip enable ($\overline{CE}$), while the ATT7C109 has two chip enables ($\overline{CE1}$ and CE2). Both devices are available in three speeds with maximum access times from 15 ns to 25 ns.

Inputs and outputs are TTL compatible. Operation is from a single 5 V power supply. Power consumption is 880 mW (maximum) at 25 ns. Dissipation drops to 110 mW (typical) for both the ATT7C108 and ATT7C109 when the memory is deselected (enable is high).

Pin Information

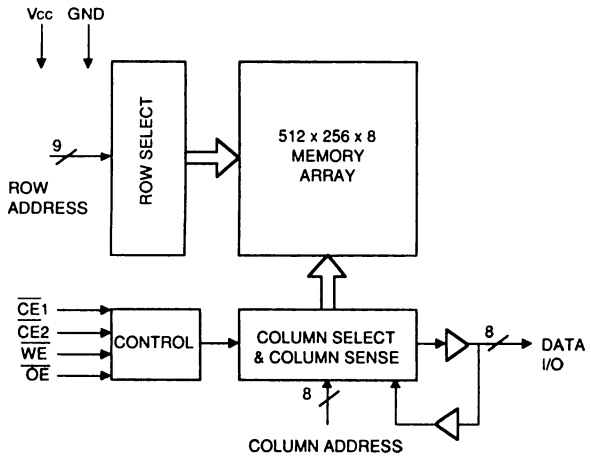

Figure 1. Block Diagram

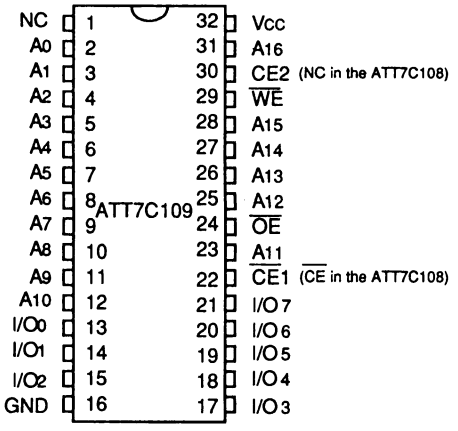

Figure 2. Pin Diagram

Table 1. Pin Descriptions

Pin	Name/Function
A0—A16	Address Inputs
I/O0—I/O7	Data Input/Output
$\overline{CE1}$, CE2	Chip Enables
$\overline{OE}$	Output Enable
$\overline{WE}$	Write Enable
GND	Ground
Vcc	+5 V Supply
NC	No Connection

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❑ AT&T Microelectronics, Dept. 52AL040420, 555 Union Boulevard, Allentown, PA 18103 **1-800-372-2447** (In Canada, **1-800-553-2448**)

ATT7C116 High-Speed CMOS SRAM
16 Kbit (2K x 8), Common I/O

Features

- 2K by 8-bit static RAM with chip-select powerdown, output enable
- Automatic powerdown during long cycles
- Advanced CMOS technology
- High speed — to 10 ns
- Low-power operation
  — Active: 500 mW typical at 25 ns
  — Standby: 100 µW typical
- Data retention at 2 V for battery backup operation
- Plug-compatible with IDT6116 and CY7C128/CY6116
- Package styles available:
  — 24-pin, plastic DIP
  — 24-pin, plastic SOJ (J-lead)

Description

The ATT7C116 device is a high-performance, low-power, CMOS static RAM organized as 2,048 words by 8 bits per word. The eight data-in and data-out signals share I/O pins. Parts are available in four speeds with worst-case access times from 10 ns to 20 ns.

Inputs and outputs are TTL compatible. Operation is from a single 5 V power supply. Power consumption for the ATT7C116 is 500 mW (typical) at 25 ns. Dissipation drops to 75 mW (typical) when the memory is deselected (enable is high).

Pin Information

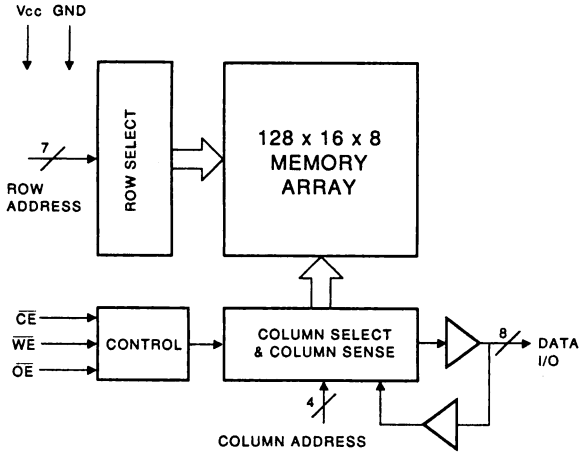

Figure 1. Block Diagram

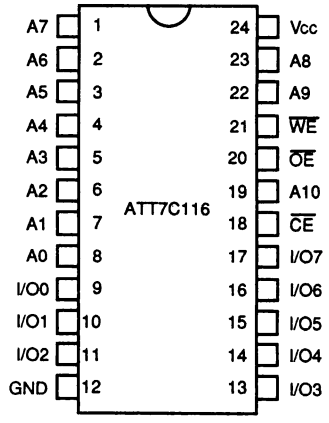

Figure 2. Pin Diagram

Table 1. Pin Descriptions

Pin	Name/Function
A0—A10	Address
I/O0—I/O7	Data Input/Output
$\overline{CE}$	Chip Enable
$\overline{OE}$	Output Enable
$\overline{WE}$	Write Enable
GND	Ground
Vcc	Power

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❑ AT&T Microelectronics, Dept. 52AL040420, 555 Union Boulevard, Allentown, PA 18103 **1-800-372-2447** (In Canada, **1-800-553-2448**)

ATT7C157 High-Speed CMOS Cache SRAM 256 Kbit (16K x 16) RISC-Based, Self-Timed, Latched Data I/O

Features

- 16,384 x 16-bit static cache RAM
- High-speed —15 ns maximum access time
- Data-in and data-out latches
- Byte write capability using $\overline{WE}0$ and $\overline{WE}1$
- Common I/O
- Self-timed write
- TTL compatible inputs and outputs
- Advanced CMOS technology
- Low-power
  — Active: 1.25 W typical at 33 ns
- Available in a 52-pin, PLCC package

Description

The ATT7C157 device is a high-performance, CMOS static cache RAM organized as 16,384 x 16 bits. It is specifically designed for use as a high-speed cache memory device. The ATT7C157 employs common I/O architecture, and a self-timed, byte-write mechanism.

Reading the device is accomplished by taking $\overline{WE}$ high, and $\overline{OE}$ low. On the rising edge of CLOCK, address A0—A13 are loaded into the input registers. A memory access occurs, and data is held after a read period cycle beyond the next rising edge of CLOCK in order to meet the hold time requirements of the microprocessor.

To write to the device correctly, $\overline{OE}$ must be taken high. If the falling edge of CLOCK samples either or both of $\overline{WE}0$ or $\overline{WE}1$, a self-timed, byte-write mechanism is triggered. Data is written from the data-in latch into the memory array at the corresponding address.

Note that the $\overline{OE}$ signal must be high for a proper write as the $\overline{WE}0$ and $\overline{WE}1$ signals do not put the outputs in the high impedance state.

Latch-up and static discharge protection are provided on-chip. The ATT7C157 can withstand an injection current of up to 200 mA on any pin without damage.

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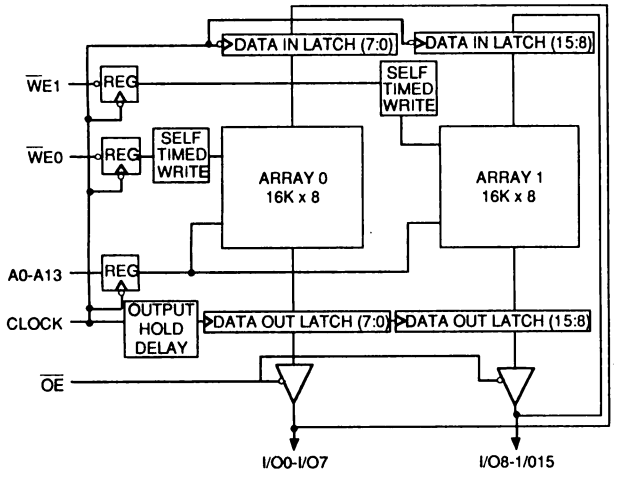

Figure 1. Block Diagram

Pin Information

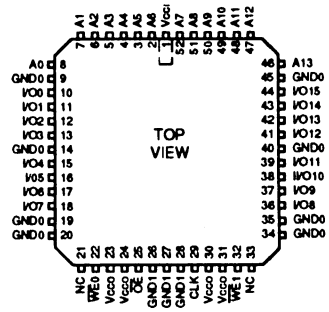

Figure 2. Pin Diagram

Table 1. Pin Descriptions

Pin	Name/Function
A0—A13	Address
I/O0—15	Data Input/Output
OE	Output Enable
CLK	Clock
$\overline{WE}$	Write Enable
GND	Ground
Vcc	Power

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❑ AT&T Microelectronics, Dept. 52AL040420, 555 Union Boulevard, Allentown, PA 18103 **1-800-372-2447** (In Canada, **1-800-553-2448**)

ATT7C164/165/166 High-Speed CMOS SRAM
64 Kbit (16K x 4), Common I/O

Features

- 16K by 4-bit static RAM with common I/O
- Automatic powerdown during long cycles
- Advanced CMOS technology
- High speed — to 10 ns
- Low-power operation
  — Active: 500 mW typical at 25 ns
  — Standby: 500 µW typical
- Data retention at 2 V for battery backup operation
- Plug-compatible with IDT7188/7198 and CY7C164/166
- Package styles available:
  — 22-/24-pin, plastic DIP
  — 24-pin, plastic SOJ (J-lead)

Description

The ATT7C164, ATT7C165, and ATT7C166 devices are high-performance, low-power, CMOS static RAMs organized as 16,384 words by 4 bits per word. The data-in and data-out signals share I/O pins. The ATT7C164 device has a single active-low chip enable, while the ATT7C165 has two chip enables and a separate output enable. The ATT7C166 Static RAM has a single chip enable and an output enable. Parts are available in four speeds with worst-case access times from 10 ns to 20 ns.

Inputs and outputs are TTL compatible. Operation is from a single 5 V power supply. Power consumption is 500 mW (typical) at 25 ns. Dissipation drops to 75 mW (typical) when the memory is deselected (enable is high).

Pin Information

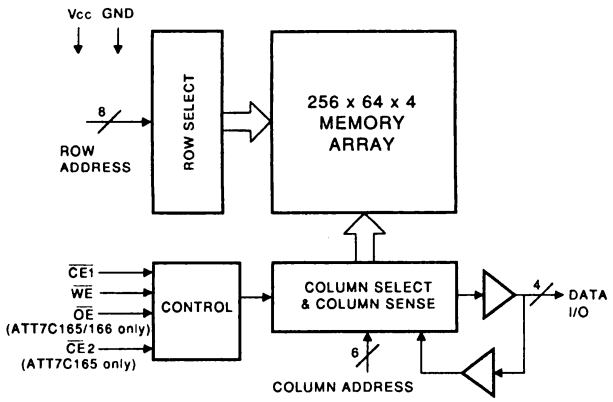

Figure 1. Block Diagram

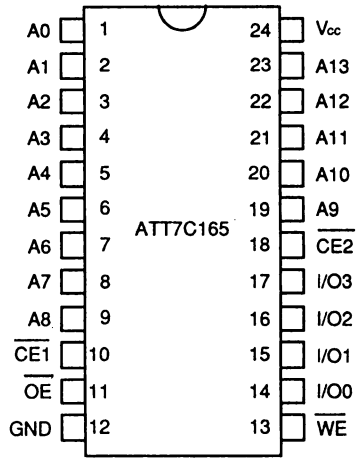

Figure 2. Pin Diagram

Table 1. Pin Descriptions

Pin	Name/Function
A0—A13	Address
I/O0—I/O3	Data Input/Output
$\overline{CE1}$ & $\overline{CE2}$	Chip Enable
$\overline{OE}$	Output Enable
$\overline{WE}$	Write Enable
GND	Ground
Vcc	Power

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ATT7C173/174 High-Speed CMOS SRAM
64 Kbit (8K x 8), Cache-Tag

Features

- 8K by 8-bit static RAM with 8-bit tag comparison logic
- Automatic powerdown during long cycles
- Advanced CMOS technology
- High-speed address-to-MATCH — to 12 ns
- High-speed flash clear
- Plug-compatible with IDT7174 and MK48H74
- Totem pole (ATT7C173) or open drain (ATT7C174) MATCH output
- Package styles available:
  — 28-pin, plastic DIP
  — 28-pin, plastic SOJ (J-lead)

Description

The ATT7C173 and ATT7C174 devices are high-performance, low-power, CMOS static RAMs which are organized as 8,192 words by 8 bits per word and which include an 8-bit data comparator with MATCH output. The devices are optimized for use as the address tag comparators in high-speed cache memory systems.

The 8-bit data is input/output on shared I/O pins, and comparison is performed between 8-bit incoming data and accessed memory locations. One ATT7C173 or ATT7C174 can map 8K cache lines into 1 Mbyte address spaces by comparing 20 address bits organized as 13-line address bits and 7-page address bits.

The ATT7C173 and ATT7C174 devices are available in four speeds with maximum access times from 12 ns to 25 ns. Operation is from a single 5 V power supply. Power consumption is 750 mW (typical) at 25 ns. Dissipation drops to 75 mW (typical) when the memory is deselected (enable is high).

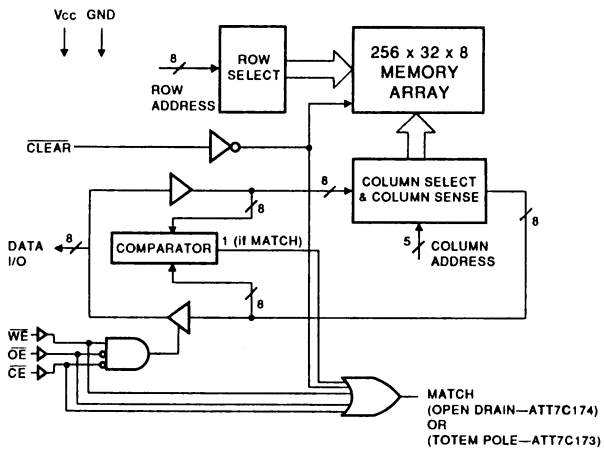

Figure 1. Block Diagram

Pin Information

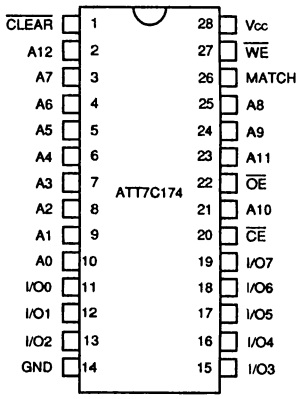

Figure 2. Pin Diagram

Table 1. Pin Descriptions

Pin	Name/Function
A0—A12	Address
I/O0—I/O7	Data Input/Output
$\overline{\text{CLEAR}}$	Clear Address Tag
MATCH	Data Comparison
$\overline{\text{CE}}$	Chip Enable
$\overline{\text{OE}}$	Output Enable
$\overline{\text{WE}}$	Write Enable
GND	Ground
Vcc	Power

For additional information, contact your AT&T Account Manager or the following:
❑ AT&T Microelectronics, Dept. 52AL040420, 555 Union Boulevard, Allentown, PA 18103 **1-800-372-2447** (In Canada, **1-800-553-2448**)

ATT7C180/181 High-Speed CMOS SRAM 16 Kbit (4K x 4), Cache-Tag

Features

- 4K by 4-bit static RAM with 4-bit tag comparison logic
- Automatic powerdown during long cycles
- Advanced CMOS technology
- High-speed address-to-MATCH — to 10 ns
- High-speed flash clear
- Low-power operation
  — Active: 325 mW typical at 25 ns
  — Standby: 100 µW typical
- Totem-pole (ATT7C180) or open-drain (ATT7C181) MATCH output
- Data retention at 2 V for battery backup operation
- Plug-compatible with IDT6178, SSL4180, SSL4181, MK41H80, and MCM4180
- Package styles available:
  — 22-pin, plastic DIP
  — 24-pin, plastic SOJ (J-lead)

Description

The ATT7C180 and ATT7C181 devices are high-performance, low-power, CMOS static RAMs organized as 4,096 words by 4 bits per word and include a 4-bit data comparator with MATCH output.

These devices are optimized for use as the address-tag comparator in high-speed cache memory systems. The 4-bit data is input/output on shared I/O pins, and comparison is performed between 4-bit incoming data and accessed memory locations. Wide tag addresses are easily accommodated by paralleling devices and ANDing or wire-ORing the MATCH outputs (ATT7C180 or ATT7C181, respectively). For either device, a low on the MATCH output indicates a data mismatch.

The ATT7C180 and ATT7C181 devices are available in four speeds with maximum address-to-MATCH times from 10 ns to 20 ns. Operation is from a single 5 V power supply. Power consumption is 325 mW (typical) at 25 ns. Dissipation drops to 75 mW (typical) when the memory is deselected.

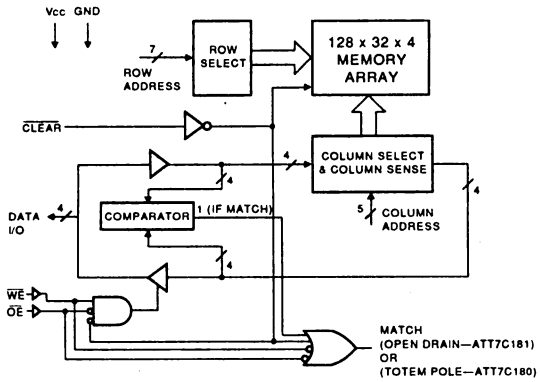

Figure 1. Block Diagram

Pin Information

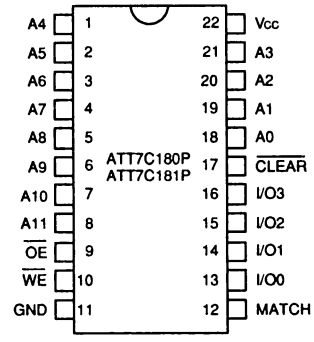

Figure 2. Pin Diagram

Table 1. DIP Pin Descriptions

Pin	Name/Function
A0—A11	Address
I/O0—I/O3	Data Input/Output
$\overline{\text{CLEAR}}$	Clear Address Tag
MATCH	Data Comparison
$\overline{\text{OE}}$	Output Enable
$\overline{\text{WE}}$	Write Enable
GND	Ground
Vcc	Power

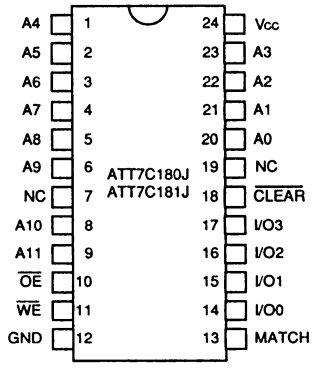

Figure 3. Pin Diagram

Table 2. SOJ Pin Descriptions

Pin	Name/Function
A0—A11	Address
I/O0—I/O3	Data Input/Output
$\overline{\text{CLEAR}}$	Clear Address Tag
MATCH	Data Comparison
$\overline{\text{OE}}$	Output Enable
$\overline{\text{WE}}$	Write Enable
GND	Ground
Vcc	Power
NC	No Connection

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ATT7C183/184 High-Speed CMOS SRAM
128 Kbit (2 x 4K x 16 or 8K x 16) Cache-Data

Features

- 2 x 4K x 16 or 8K x 16 cache-data static RAM with direct map or two-way set associative
- Automatic powerdown during long cycles
- Advanced CMOS technology
- High-speed — to 25 ns
- Plug-compatible with Cypress CY7C183/184
- Low-power operation
  - — Active: 700 mW typical at 45 ns
  - — Standby: 75 mW typical
- Data retention at 2 V for battery backup operation
- Package styles available:
  - — 48-pin, plastic DIP
  - — 52-pin, plastic LCC

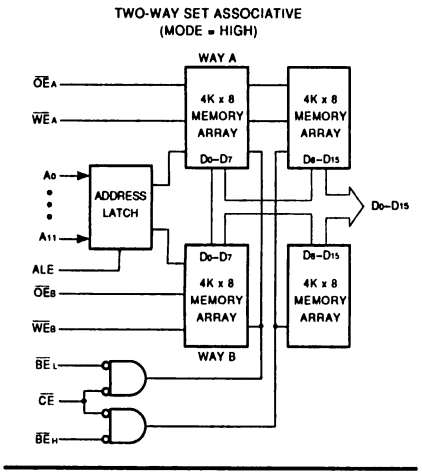
Description

The ATT7C183 and ATT7C184 devices are high-performance, low-power, CMOS static RAMs organized into either two two-way set associative blocks of 4K x 16 RAM or one directly mapped 8K x 16-bit RAM.

The ATT7C183 and ATT7C184 are designed specifically for use with the Intel 82385 Cache Controller. Addresses are latched on the falling edge of the address-latch-enable (ALE) signal. When ALE is high, the latch is transparent. The ATT7C183 has all address bits latched by the ALE signal except A12. A12, which bypasses the latch, has a faster access time. In the ATT7C184, all address bits are latched by the ALE signal. Operation is from a single 5 V power supply, and all interface signals are TTL compatible. Power consumption is 700 mW (typical) at 45 ns.

AT&T Microelectronics

Pin Information



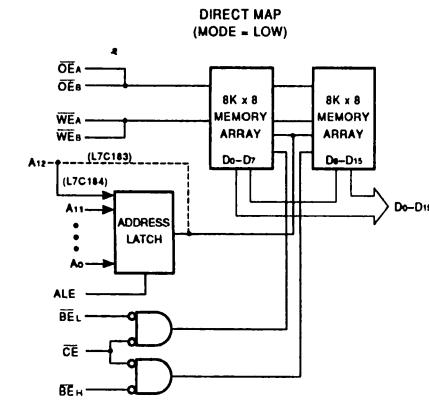


Figure 1. Block Diagram

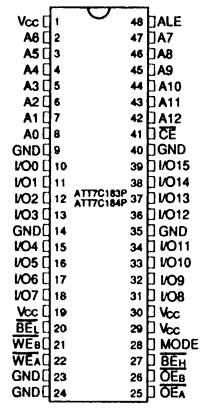


Figure 2. Pin Diagram

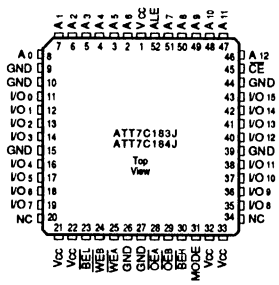


Figure 3. Pin Diagram

Table 1. DIP Pin Descriptions

Pin	Name/Function
A0—A12	Address
I/O0—I/O15	Data Input/Output
$\overline{CE}$	Chip Enable
$\overline{WE_A}$ and $\overline{WE_B}$	Write Enable
$\overline{OE_A}$ and $\overline{OE_B}$	Output Enable
$\overline{BE_L}$ and $\overline{BE_H}$	Bank Enable
ALE	Address Latch Enable
MODE	Configuration Mode
GND	Ground
V_{CC}	Power

Table 2. PLCC Pin Descriptions

Pin	Name/Function
A0—A12	Address
I/O0—I/O15	Data Input/Output
$\overline{CE}$	Chip Enable
$\overline{WE_A}$ and $\overline{WE_B}$	Write Enable
$\overline{OE_A}$ and $\overline{OE_B}$	Output Enable
$\overline{BE_L}$ and $\overline{BE_H}$	Bank Enable
ALE	Address Latch Enable
MODE	Configuration Mode
GND	Ground
V_{CC}	Power
NC	No Connection

For additional information, contact your AT&T Account Manager or the following:
❑ AT&T Microelectronics, Dept. 52AL040420, 555 Union Boulevard, Allentown, PA 18103 **1-800-372-2447** (In Canada, **1-800-553-2448**)

ATT7C185 High-Speed CMOS SRAM
64 Kbit (8K x 8), Common I/O

Features

- 8K by 8-bit static RAM with chip-select powerdown, output enable
- Automatic powerdown during long cycles
- Advanced CMOS technology
- High speed — to 10 ns
- Low-power operation
  — Active: 750 mW typical at 25 ns
  — Standby : 500 µW typical
- Data retention at 2 V for battery backup operation
- Plug-compatible with IDT7164 and CY7C185/186
- Package styles available:
  — 28-pin, plastic DIP
  — 28-pin, plastic SOJ

Description

The ATT7C185 device is a high-performance, low-power, CMOS static RAM organized as 8,192 words by 8 bits per word. The eight data-in and data-out signals share I/O pins. Parts are available in five speeds with worst-case access times from 10 ns to 25 ns.

Inputs and outputs are TTL compatible. Operation is from a single 5 V power supply. Power consumption for the ATT7C185 is 750 mW (typical) at 25 ns. Dissipation drops to 75 mW (typical) when the memory is deselected (enable is high). Two standby modes are available.

Pin Information

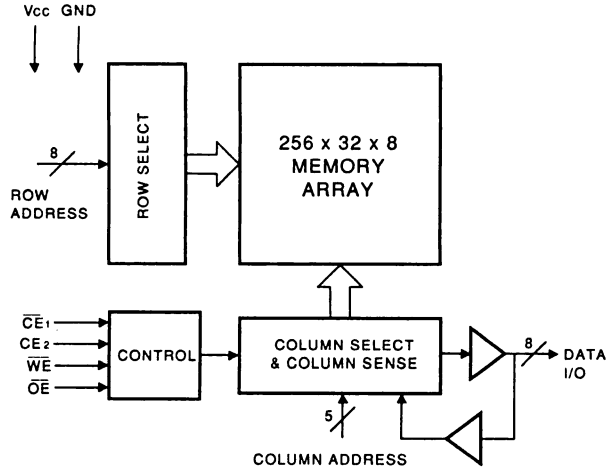


Figure 1. Block Diagram

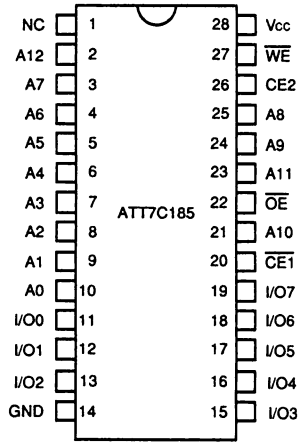


Figure 2. Pin Diagram

Table 1. Pin Descriptions

Pin	Name/Function
A0—A12	Address
I/O0—I/O7	Data Input/Output
$\overline{CE1}$ & CE2	Chip Enable
$\overline{OE}$	Output Enable
$\overline{WE}$	Write Enable
GND	Ground
Vcc	Power
NC	No Connection

AT&T Microelectronics

For additional information, contact your AT&T Account Manager or the following:
❑ AT&T Microelectronics, Dept. 52AL040420, 555 Union Boulevard, Allentown, PA 18103 **1-800-372-2447** (In Canada, **1-800-553-2448**)

ATT7C194/195/196 High-Speed CMOS SRAM
256 Kbit (64K x 4), Common I/O

Features

- High-Speed —12 ns maximum access times
- 64K by 4-bit static RAM with common I/O
- Automatic powerdown during long cycles
- Plug-compatible with IDT71258/61298 and CY7C194/196
- Low-power operation
  - — Active: 500 mW typical at 25 ns
  - — Standby: 10 mW typical
- Data retention at 2 V for battery backup operation
- Package styles available:
  - — 24-/28-pin, plastic DIP
  - — 24-/28-pin, plastic SOJ (J-lead)

Description

The ATT7C194, ATT7C195, and ATT7C196 devices are high-performance, low-power, CMOS static RAMs organized as 65,536 words by 4 bits per word. Data-in and data-out signals share I/O pins. The ATT7C194 has a single active-low chip enable, the ATT7C195 has a single chip enable and an output enable, and the ATT7C196 has two chip enables and a separate output enable.

The ATT7C194, ATT7C195, and ATT7C196 devices are available in four speeds with maximum access times from 12 ns to 25 ns. Inputs and outputs are TTL compatible. Operation is from a single 5 V power supply. Power consumption is 500 mW (typical) at 25 ns. Dissipation drops to 100 mW (typical) when the memory is deselected (enable is high).

Pin Information

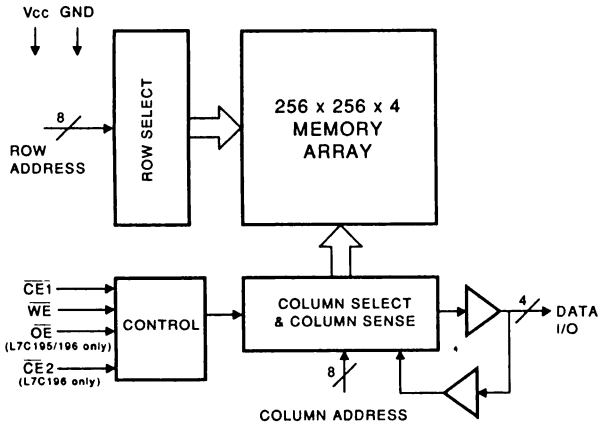


Figure 1. Block Diagram

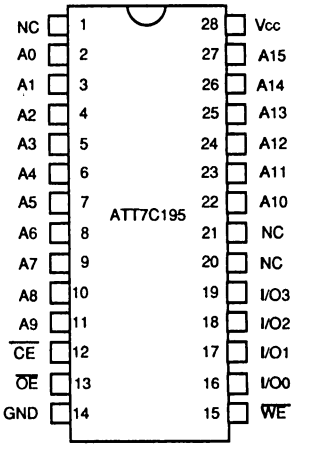


Figure 2. Pin Diagram

Table 1. Pin Descriptions

Pin	Name/Function
A0—A15	Address
I/O0—I/O3	Data Input/Output
$\overline{CE}$	Chip Enable
$\overline{OE}$	Output Enable
$\overline{WE}$	Write Enable
GND	Ground
Vcc	Power
NC	No Connection

AT&T Microelectronics

For additional information, contact your AT&T Account Manager or the following:
❑ AT&T Microelectronics, Dept. 52AL040420, 555 Union Boulevard, Allentown, PA 18103 **1-800-372-2447** (In Canada, **1-800-553-2448**)

ATT7C199 High-Speed CMOS SRAM
256 Kbit (32K x 8), Common I/O

Features

- High Speed —12 ns maximum access times
- 32K by 8-bit static RAM with chip-select powerdown, output enable
- Automatic powerdown during long cycles
- Advanced CMOS technology
- Plug-compatible with IDT71256 and CY7C198/199
- Low-power operation
  — Active: 750 mW typical at 25 ns
  — Standby: 10 mW typical
- Data retention at 2 V for battery backup operation
- Package styles available:
  — 28-pin, plastic DIP
  — 28-pin, plastic SOJ (J-lead)

Description

The ATT7C199 device is a high-performance, low-power, CMOS static RAM organized as 32,768 words by 8 bits per word. The eight data-in and data-out signals share I/O pins.

The ATT7C199 device is available in four speeds with maximum access times from 12 ns to 25 ns. Inputs and output are TTL compatible. Operation is from a single 5 V power supply. Power consumption is 750 mW (typical) at 25 ns. Dissipation drops to 100 mW (typical) when the memory is deselected (enable is high).

Pin Information

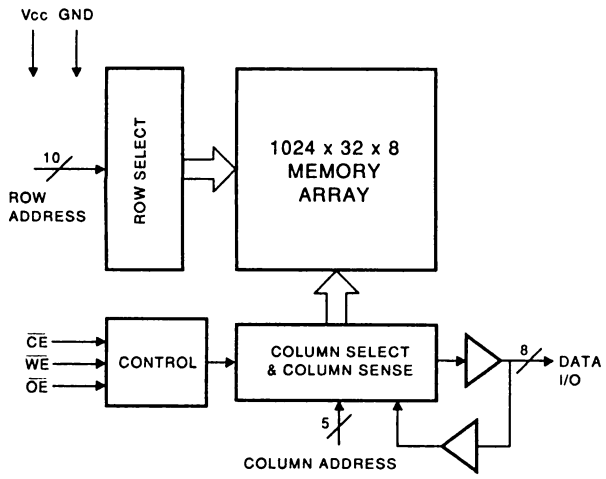


Figure 1. Block Diagram

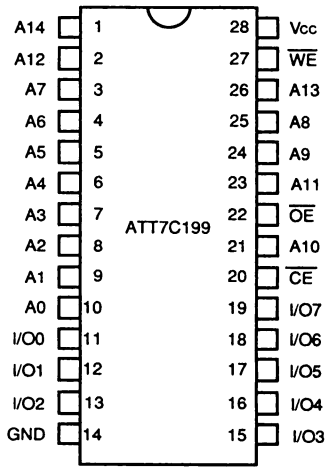


Figure 2. Pin Diagram

Table 1. Pin Descriptions

Pin	Name/Function
A0—A14	Address
I/O0—I/O7	Data Input/Output
$\overline{CE}$	Chip Enable
$\overline{OE}$	Output Enable
$\overline{WE}$	Write Enable
GND	Ground
Vcc	Power

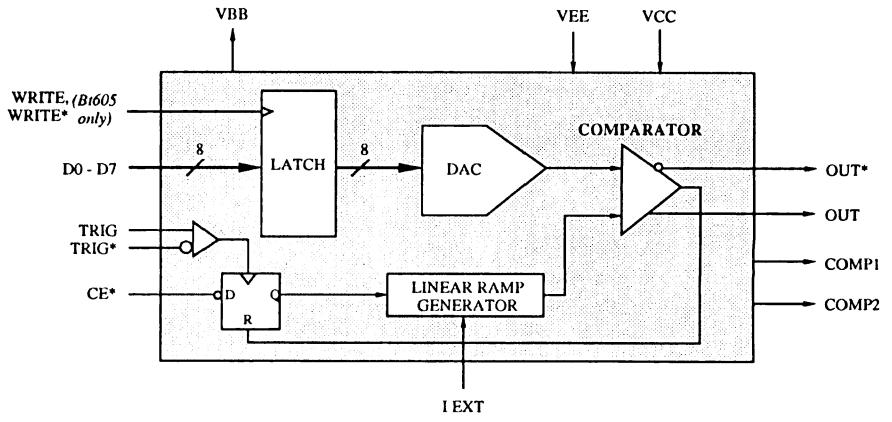
AT&T Microelectronics

For additional information, contact your AT&T Account Manager or the following:
❑ AT&T Microelectronics, Dept. 52AL040420, 555 Union Boulevard, Allentown, PA 18103 **1-800-372-2447** (In Canada, **1-800-553-2448**)

Timing Edge Verniers and Delay Lines

Bt604/605— Timing Edge Verniers

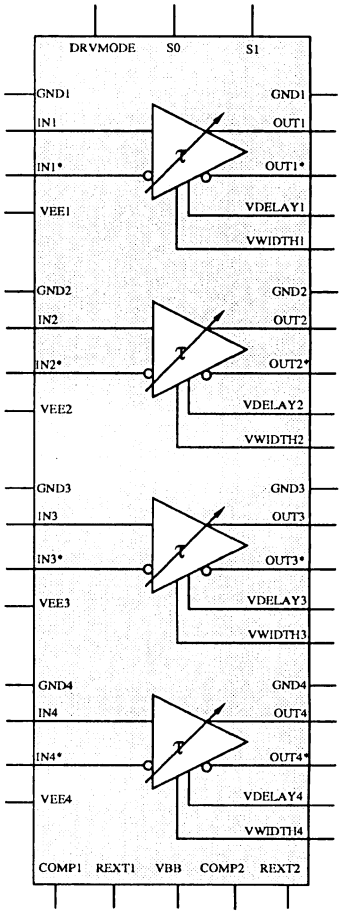
- 125 MHz Maximum Trigger Rate
- Less Than ±1 LSB Timing Accuracy
- 15 ps Delay Resolution (4 ns span)
- Extendable Delay Span to 40 ns
- Differential Tigger Inputs
- 10KH ECL Compatible
- Monolithic Construction
- 28-pin Plastic J-Lead Package
- Typical Power: 750 mW



Bt604 — On-The-Fly Timing Edge Vernier
Bt605 — Programmable Timing Edge Vernier

Bt622/624— Dual and Quad Delay Lines

- Capable of Transmitting Distortion-free 2.5 ns Pulse
- Independent Delay Adjustments for Positive- and Negative-Going Transitions
- Three Selectable Delay Ranges: 10, 20, 30 ns
- Mode Control for Common Signal Distribution to All Channels
- Delays Adjustable via External Voltages/Currents/or Resistors-to-Ground
- Individual GND/VEE Pins per Delay Section for Superior Crosstalk Performance
- 10KH ECL Compatible
- Cascadable for Greater Delays and/or Multiple Taps
- Bt622—Dual Channel offers 2 Adjustable Delay Lines in a 28-pin Plastic J-Lead Package with Internal Heat Spreader
- Bt624—Quad Channel offers 4 Adjustable Delay Lines in a 44-pin Plastic J-Lead Package with Internal Heat Spreader



Bt624 — Quad Channel Delay Line

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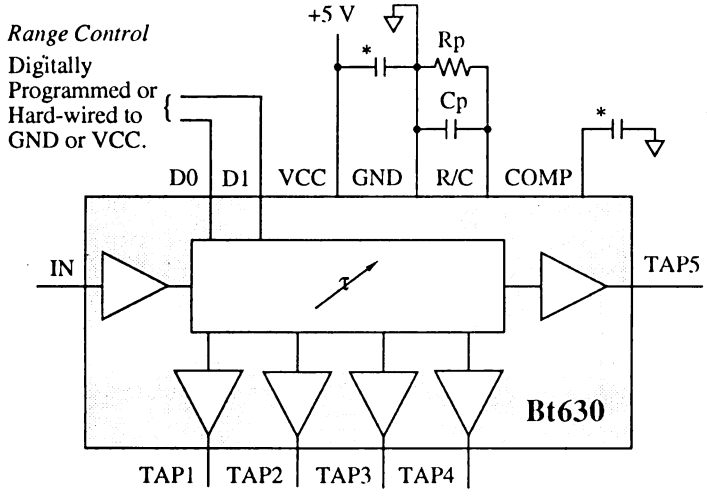
The Company that pioneered RAMDACs

ATE Pin Timing
Bt630

5–400 ns Continuously Adjustable Delay Line

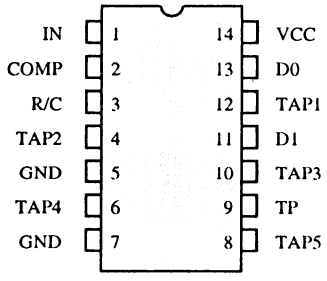
Features

- Reliable CMOS monolithic construction
- Continuously adjustable
- High bandwidth
- Leading and trailing edge accuracy
- Low profile, auto-insertable
- Vapor phase, IR and wave solderability
- Very low power
- TTL compatible
- Reduce inventory, stock one delay line
- Demonstration Board available
- 5–400 ns adjustable delay range (25–400 ns full scale)
- Five buffered taps at 20, 40, 60, 80 and 100% of full-scale delay
- Up to 50 MHz Bandwidth
- 15 ns Minimum Input Pulse Width
- 50 mW Typical Power
- Output delay accuracies to ±5% or ±2 ns, whichever is greater
- Standard 14-pin DIP package



* = 0.1 microfarad ceramic capacitor, 10%.

Bt630 Pinout



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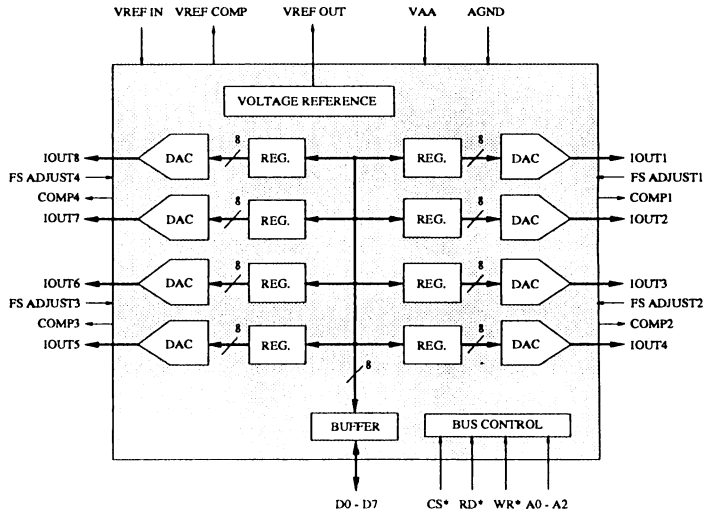
ATE Product Support
Bt110, Bt501/502, and Evaluation Modules

ATE Support Products

Bt110 Octal 8-bit DAC

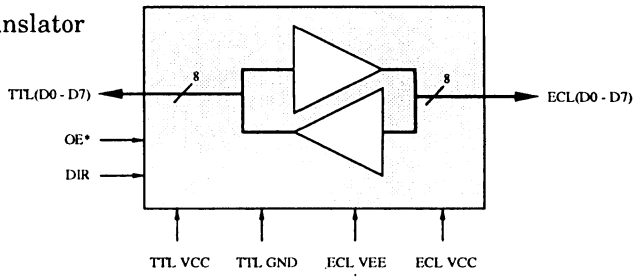
- Eight 8-bit D/A Converters
- 100 ns Settling Time
- ±1 LSB Differential Linearity Error
- ±1 LSB Integral Linearity Error
- Guaranteed Monotonic
- Standard MPU Interface
- +5 V CMOS Monolithic Construction
- 44-pin Plastic J-lead (PLCC) Package
- Typical Power: 150 mW

- Interfaces easily to the Bt604/605, Bt622/624, and the Bt698



Bt501/502 TTL/ECL Transceiver/Translator

- Octal TTL/ECL Bidirectional Transceiver/Translator
- Single 5 V Operation Possible
- 10KH and 100K ECL Compatible
- Separate ECL and TTL Supply Pins
- TTL-Compatible Control Signals
- Three-statable TTL bus
- 24-pin 0.3" CERDIP Package
- Typical Power: 800 mW



Product Evaluation Modules

Evaluation modules with complete documentation are available for the following Brooktree ATE products:

Bt604/Bt605 — Timing Edge Verniers

Bt622/Bt624 — Dual and Quad Delay Lines

Bt630 — Demonstration board for the Adjustable Delay Line

Bt681 — Ultra Fast, High Voltage Window Comparator

Bt692 — Monolithic Dual Driver

Bt698 — Pin Electronics Load/Driver/Comparator

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ATE Pin Electronics Products
Bt681/687/688
Bt692, Bt698

Comparators, Drivers, and Loads

Brooktree's Comparator Family

Bt681—Ultra Fast High Voltage Window Comparator
Bt687—Ultra Fast ECL Dual Comparator
Bt688—High Speed Dual Comparator

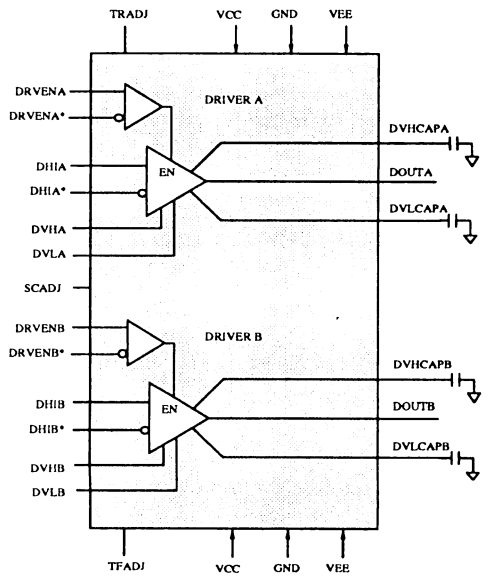
	Bt681	Bt687	Bt688
Prop. Dispersion	±100 ps	±75 ps	±150 ps
Common-mode Input Range	12 V (+8/–4 V typ)	±3.3 V	14 V (+10/–4V)
Input Tracking Rate	3 V/ns	4 V/ns	1 V/ns
Prop. Delay	3.0 ns	1.8 ns	2.8 ns
Packages	28-pin PLCC	16-pin CERDIP 16-pin SOIC 20-pin CLCC	16-pin PDIP 16-pin SOIC

Bt692 Monolithic Dual Driver

- Two Independent Pin Electronics Drivers
- Three-statable
- Independent Rise/Fall Time Adjustments
- 11 V Programmable Output Range
- Driven by ECL, TTL or CMOS Logic
- Compatible to Bt698 Driver
- 28-pin PLCC with Internal Heat Spreader
- The Bt692 is a perfect companion to the Bt698

Bt698 Load/Driver/Comparator

- Industry-first Integration of High-voltage Driver/Load/Comparator Functions
- Includes a Three-statable Driver, Dual Comparator and Dynamic Active Load
- 11 V Programmable Driver Output Range
- ±60 mA Programmable Load Current
- 3.0 ns Comparator Propagation Delays
- 11 V Comparator Input Voltage Range
- 44-pin Plastic J-Lead package with Internal Heat Spreader



Bt692 Block Diagram

Brooktree

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For detailed product data sheets, please call the toll-free number below, or contact your Burr-Brown sales engineer or representative.

OPERATIONAL AMPLIFIERS

LOW DRIFT OPERATIONAL AMPLIFIERS (≤5µV/°C)

Description	Model	Offset Voltage, max: At 25°C, (±mV)	Offset Voltage, max: Temp Drift, (±µV/°C)	Bias Current (25°C), max (pA)	Open Loop Gain, min (dB)	Frequency Response: Unity Gain (MHz)	Frequency Response: Slew Rate (V/µs)	Rated Output, min: (±V)	Rated Output, min: (±mA)	Temperature Range[1]	Package
FET	OPA627M	0.1	0.8	5	112	16	40	11.5	30	Ind	TO-99
	OPA627P	0.25	2	5	112	16	40	11.5	30	Ind	DIP
	OPA637M	0.1	0.8	5	112	80	100	11.5	30	Ind	TO-99
	OPA637P	0.25	2	5	112	80	100	11.5	30	Ind	DIP
	OPA111M	0.25	1	1	120	2	2	11	5	Ind	TO-99
Wideband	OPA156M	2	5	50	94	6	14	10	5	Mil	TO-99
	OPA356M	2	5	50	94	6	14	10	5	Com	TO-99
	OPA602M	0.25	2	1	92	6.5	28	10	15	Ind	TO-99
	OPA602P, U	1	5	2	88	6.5	24	10	15	Ind	DIP, SOIC
	OPA606M	1	10	10	100	13	35	12	5	Com	TO-99
Dual FET	OPA2111M	0.5	2.8	4	114	2	2	11	5	Ind	TO-99
	OPA2107P	1	10	10	80	5	15	11	10	Ind	DIP, SOIC
Low Power (Dual) Single Supply Operation	OPA1013	0.15	2	20nA	123	0.8	0.4	13	5	Com	DIP, TO-99
Bipolar	OPA177Z, P	0.01	0.1	1.5nA	134	0.6	0.3	12	10	Ind	DIP
	OPA177S	0.06	1.2	2.8nA	126	0.6	0.3	12	10	Ind	SOIC
	OPA77Z, P	0.025	0.3	2.0nA	134	0.6	0.3	12	10	Ind	DIP
	OPA27J, Z	0.025	0.6	±40nA	120	8	1.9[3]	12	16.6	Mil	TO-99, DIP
	OPA37J, Z	0.025	0.6	±40nA	120	63[2]	11.9[3]	12	16.6	Mil	TO-99, DIP
	OPA27P	0.100	1.8	±80nA	117	8	1.9[3]	12	16.6	Com	DIP
	OPA37P	0.100	1.8	±80nA	117	63[2]	11.9[3]	12	16.6	Com	DIP

NOTES: (1) Com = 0°C to +70°C, Ind = –25°C to +85°C, Mil = –55°C to +125°C. (2) Gain-bandwidth product for OPA37. A_V = 5 min. (3) Typical.

LOW BIAS CURRENT OPERATIONAL AMPLIFIERS (≤50pA)

Description	Model	Offset Voltage, max: At 25°C, (±mV)	Offset Voltage, max: Temp Drift, (±µV/°C)	Bias Current (25°C), max (pA)	Open Loop Gain, min (dB)	Frequency Response: Unity Gain (MHz)	Frequency Response: Slew Rate (V/µs)	Rated Output, min: (±V)	Rated Output, min: (±mA)	Temperature Range[1]	Package
FET	OPA111M	0.25	1	±1	120	2	2	11	5	Ind	TO-99
	OPA627M	0.1	0.8	5	112	16	40	12	30	Ind	TO-99
	OPA627P	0.25	2	5	112	16	40	12	30	Ind	DIP
	OPA637M	0.1	0.8	5	112	80	100	11.5	30	Ind	TO-99
	OPA637P	0.25	2	5	112	80	100	11.5	30	Ind	DIP
Low Noise	OPA101M	0.25	5	–10	94	10	6.5	12	12	Ind	TO-99
	OPA102M	0.25	5	–10	94	40	14	12	12	Ind	TO-99
Ultra-Low Bias Current	OPA128M	0.5	5	±0.075	110	1	3	10	5	Com	TO-99
	AD515H	1	25	0.075	88	0.35	1	10	5	Com	TO-99

(Continued on next page.)

For Immediate Product Assistance, Call Toll-Free 1-800-548-6132

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LOW BIAS CURRENT OPERATIONAL AMPLIFIERS (≤50pA) (Continued)

Description	Model	Offset Voltage, max: At 25°C, (±mV)	Offset Voltage, max: Temp Drift, (±µV/°C)	Bias Current (25°C), max (pA)	Open Loop Gain, min (dB)	Frequency Response: Unity Gain (MHz)	Frequency Response: Slew Rate (V/µs)	Rated Output, min: (±V)	Rated Output, min: (±mA)	Temperature Range[1]	Package
Dual FET	OPA2111M	0.5	2.8	±4	114	2	2	11	5	Ind	TO-99
	OPA2111P	2	15	±15	106	2	2	11	5	Com	DIP
	OPA2107P	1	10	10	80	5	15	11	10	Ind	DIP, SOIC
Quad FET	OPA404G	0.75	3[2]	±4	92	6.4	35	12	5	Ind	DIP
	OPA404P, U	2.5	5[2]	±12	88	6.4	35	11.5	5	Com	DIP, SOIC
Low Cost	OPA121M	2	10	±5	110	2	2	11	5	Com	TO-99
	OPA121P, U	3	10	±10	106	2	2	11	5	Com	DIP
	OPA602M	0.25	2	1	92	6.5	28	10	15	Ind	TO-99
	OPA602P	0.5	5	2	88	6.5	24	10	15	Ind	DIP, SOIC
Wideband	OPA606M	0.5	5	±10	100	13	35	12	5	Com	TO-99
	OPA606P	3	10[2]	±25	90	12	30	11	5	Com	DIP

NOTES: (1) Com = 0°C to +70°C, Ind = –25°C to +85°C, Mil = –55°C to +125°C. (2) Typical.

LOW NOISE OPERATIONAL AMPLIFIERS (Very Low e_N)

Description	Model	Noise Voltage at 10kHz, max ($nV/\sqrt{Hz}$)	Bias Current (25°C), max (nA)	Offset Voltage, max: at 25°C (±mV)	Offset Voltage, max: Temp Drift (±µV/°C)	Open Loop Gain, min (dB)	Frequency Response: Gain BW (MHz)	Frequency Response: Slew Rate, min (V/µs)	Rated Output, min: (±V)	Rated Output, min: (±mA)	Temp Range[1]	Package
Bipolar	OPA27J, Z	3.8	±40	0.025	0.6	120	8	1.9[2]	12	16.6	Mil	TO-99, DIP
	OPA37J, Z	3.8	±40	0.025	0.6	120	63	11.9[2]	12	16.6	Mil	TO-99, DIP
	OPA177Z, P	10	1.5	0.01	0.1	134	0.6	0.3	12	10	Ind	DIP
	OPA177S	10	2.8	0.06	1.2	126	0.6	0.3	12	10	Ind	SOIC
	OPA77Z, P	11	2.0	0.025	0.3	134	0.6	0.3	12	10	Ind	DIP
Wide Bandwidth	OPA101M	8	–10	0.25	5	94	20	5	12	12	Ind	TO-99
	OPA102M	8	–10	0.25	5	94	40	10	12	12	Ind	TO-99
FET	OPA111M	8	±1	0.25	1	120	2	1	11	5	Ind	TO-99
	OPA602M	12[2]	1	0.25	2	92	6.5	28	10	15	Ind	TO-99
	OPA627M	6	5	1	0.8	112	16	45	11.5	30	Ind	TO-99
	OPA627P	6	5	0.25	2	112	16	40	11.5	30	Ind	DIP
	OPA637M	6	5	1	0.8	112	80	100	11.5	30	Ind	TO-99
	OPA637P	6	5	0.25	2	112	80	100	11.5	30	Ind	DIP
Low Cost	OPA27P, U	4.5	±80nA	0.100	1.8	117	8	1.9[2]	10	16.6	Com	DIP, SOIC
	OPA37P, U	4.5	±80nA	0.100	1.8	117	63	11.9[2]	10	16.6	Com	DIP, SOIC
Dual FET	OPA2111M	8	±4	0.5	2.8	114	2	1	11	5	Ind	TO-99
	OPA2111P	6[2]	±15	2	15	106	2	1	11	5	Com	DIP
Dual Audio Op Amp	OPA2604	10	100	3	8 typ	80	20	15	11	35	Ind	DIP, SOIC

NOTES: (1) Ind = –25°C to +85°C, Mil = –55°C to +125°C, Com = 0°C to +70°C. (2) Typical.

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UNITY-GAIN BUFFER OPERATIONAL AMPLIFIERS

Description	Model	Rated Output, min (±V)	Rated Output, min (±mA)	Frequency Response –3dB (MHz)	Frequency Response Full Power (MHz)	Frequency Response Slew Rate (V/µs)	Gain (V/V)	Input Impedance (Ω)	Temp Range[1]	Pkg
High Performance	3553AM	10	200	300	32	2000	≈1	10^{11}	Ind	TO-3
Low Cost	OPA633P	11	80	260	40	2500	≈1	1.5×10^{6}	Com	DIP
Transconductance Amp and Buffer	OPA660	4	8	700	550	2000	≈1	10^{6}	Ind	DIP, SOIC

NOTE: (1) Ind = –25°C to +85°C, Com = 0°C to +70°C

WIDE BANDWIDTH OPERATIONAL AMPLIFIERS (≥5MHz)

Description	Model	Frequency Response Gain BW (MHz)	Frequency Response Slew Rate min (V/µs)	Frequency Response t_S ±0.1% (ns)	Comp	Rated Output, min (±V)	Rated Output, min (±mA)	Offset Voltage, max At 25°C (±mV)	Offset Voltage, max Temp Drift (±µV/°C)	Open Loop Gain, min (dB)	Temp Range[1]	Package
FET	OPA156M	6	10	1.5µs	Int	10	5	2	5	94	Mil	TO-99
	OPA356M	6	10	1.5µs	Int	10	5	2	5	94	Com	TO-99
	OPA602M	6.5	28	600	Int	10	15	0.25	2	92	Ind	TO-99
	OPA602P, U	6.5	24	600	Int	10	15	0.5	5	88	Ind	DIP, SOIC
Dual	OPA2107	5	15	1µs	Int	11	10	0.5	5	82	Ind, Mil	DIP, TO-99, SOIC
Dual Audio	OPA2604	20	15	1	Int	11	35	3	8 typ	82	Ind	DIP, TO-99
	OPA605M	200, A = 1000	300[3]	300	Ext	10	30	0.5	5	96[3]	Ind	DIP
	OPA606M	13	25	1µs	Int	12	5	0.5	5[2]	100	Com	TO-99
	OPA606P	12	20	1µs	Int	11	5	3	10[2]	90	Com	TO-99
	OPA627M	16	45	400	Int	11.5	30	0.1	0.8	112	Ind	TO-99
	OPA627P	16	40	400	Int	11.5	30	0.25	2	112	Ind	DIP
	OPA637M	50	100	300	G > 5	11.5	30	0.1	0.8	112	Ind	TO-99
	OPA637P	50	100	300	G > 5	11.5	30	0.25	2	112	Ind	DIP
	3554M	1700, A = 1000	1000	120	Ext	10	100	1	15	100	Ind	TO-3
	3551	50, A = 10	250	400	Ext	10	10	1	50[2]	88	Com	TO-99
	3550	20, A = 1	100	400	Int	10	10	1	50[2]	88	Com	TO-99
Current-Feedback	OPA603P	50 (A = 1 to 10)	1000	50	NA	10	75	5	8 typ	NA	Ind	DIP
Transconductance Amp & Buffer	OPA660	700	2000	25	NA	4.0	20	20	50	NA	Ind	DIP, SOIC
Quad FET	OPA404G	6.4	28	600	Int	11.5	5	0.75	3[2]	92	Ind	DIP
	OPA404P, U	6.4	24	600	Int	11.5	5	2.5	5[2]	88	Com	DIP, SOIC
Low Noise Bipolar	OPA27	8, A = 1	1.9[2]	—	Int[3]	12	16.6	0.025	0.6	120	Mil	TO-99, DIP
	OPA37	63, A = 5	11.9[2]	—	Int[3]	12	16.6	0.025	0.6	120	Mil	TO-99, DIP
Low Noise FET	OPA101M	20, A = 100	5	2.5µs	Int	12	12	0.25	5	94	Ind	TO-99
	OPA102M	40, A = 100	10	1.5µs	Int	12	12	0.25	5	94	Ind	TO-99

(Continued on next page.)

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WIDE BANDWIDTH OPERATIONAL AMPLIFIERS (≥5MHz) (Continued)

Description	Model	Frequency Response: Gain BW (MHz)	Frequency Response: Slew Rate min (V/µs)	Frequency Response: t_S ±0.1% (ns)	Comp	Rated Output, min: (±V)	Rated Output, min: (±mA)	Offset Voltage, max: At 25°C (±mV)	Offset Voltage, max: Temp Drift (±µV/°C)	Open Loop Gain, min (dB)	Temp Range[1]	Package
Fast Settling	OPA600M	5000, A = 1000	500	80	Ext	9	180	4	40	86	Ind	DIP
Very Fast	OPA620	200	175[2]	10	Int	3	150[2]	0.5	8[2]	55	Com, Mil	DIP, SOIC
Settling	OPA621	500, A = 10	350[2]	15	Int	3	150[2]	0.5	12[2]	55	Com, Mil	DIP, SOIC
Precision												
Very Fast Settling	OPA675G	3000, A = 16	240	15	Ext	2.1	30[2]	1	5	65	Com, Mil	DIP
DIP Input	Switched OPA676G	3000, A = 16	240	15	Ext	2.1	30[2]	1	5	65	Com, Mil	DIP
Low Cost	OPA27P, U	8, A = 1	1.9[2]	—	Int	12	16.6	0.100	1.8	117	Com	DIP, SOIC
	OPA37P, U	63, A = 5	11.9[2]	—	Int[3]	12	16.6	0.100	1.8	117	Com	DIP, SOIC

NOTES: (1) Com = 0°C to +70°C, Ind = –25°C to +85°C, Mil = –55°C to +125°C. (2) Typical. (3) G = 5 min for OPA37.

HIGH VOLTAGE, HIGH CURRENT OPERATIONAL AMPLIFIERS

Description	Model	Rated Output, min: (±V)	Rated Output, min: (±mA)	Offset Voltage, max: At 25°C (±mV)	Offset Voltage, max: Temp Drift (±µV/°C)	Bias Current (25°C), max (pA)	Frequency Response: Unity Gain (MHz)	Frequency Response: Slew Rate (V/µs)	Open Loop Gain (dB)	Temp Range[1]	Package
High Power	OPA501M	26	10A	5	40	20nA	1	1.35	98	Ind	TO-3
	OPA511M	22	5A	10	65	40	1	1	91	Ind	TO-3
	OPA512BM	35	10A	6	65	30	4	2.5	110	Ind	TO-3
	OPA512SM	35	15A	3	40	20	4	2.5	110	Mil	TO-3
	OPA541M	35	5A	1	30	50	1.6	6	90	Ind	TO-3
	OPA541AP	30	5A	10	40	50	1.6	6	90	Ind	Power Plastic
Dual	OPA2541M	35	5A	1	30	50	1.6	8	90	Ind	TO-3
	3573M	20	2A[4]	10	65	40nA	1	2.6	94	Ind	TO-3
Wideband	3554M	10	100	1	15	50	1700[2]	1200	100	Ind	TO-3
High Voltage	3584M	145	15	3	25	20	20[2]	150	126	Com	TO-3
	3583M	140	75	3	25	20	5	30	118	Ind	TO-3
	3582	145	15	3	25	20	5	20	118	Com	TO-3
	3581	70	30	3	25	20	5	20	112	Com	TO-3
	3580	30	60	10	30	50	5	15	106	Com	TO-3
	OPA445BM	35	15	3	10	50	2	10	100	Ind	TO-99
Buffer	3553M	10	200	50	300[5]	200	300	2000	NA	Ind	TO-3
	OPA633	11	80	15	33[5]	35µA	260[5]	2500	NA	Com	DIP

NOTES: (1) Com = 0°C to +70°C, Ind = –25°C to +85°C, Mil = –55°C to +125°C. (2) Gain-bandwidth product. (3) 2A peak. (4) 5A peak. (5) Typical.

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SPECIAL PURPOSE OPERATIONAL AMPLIFIERS

Description	Model	Offset Voltage, max: At 25°C, (±mV)	Offset Voltage, max: Temp Drift, (±µV/°C)	Bias Current (25°C), max (nA)	Open Loop Gain, min (dB)	Frequency Response: Unity Gain (MHz)	Frequency Response: Slew Rate (V/µs)	Rated Output, min: (±V)	Rated Output, min: (±mA)	Temp Range[1]	Package
Very Fast Settling	OPA675G	1	5	35µA	65	185[3]	350	2.1	30	Com, Mil	DIP
	OPA676G	1	5	35µA	65	185[3]	350	2.1	30	Com, Mil	DIP

NOTES: (1) Com = 0°C to +70°C, Mil = –55°C to +125°C. (2) –3dB BW at Gain of +10V/V.

INSTRUMENTATION AMPLIFIERS

INSTRUMENTATION AMPLIFIERS

Description	Model	Gain Range	Gain Accuracy, G = 100 25°C, max (%)	Gain Drift, G = 100 (ppm/°C)	Non-Linearity G = 100 max (%)	Input Parameters: CMR[6] min (dB)	Input Parameters: Offset Voltage vs Temp max (µV/°C)	Dynamic Response, G = 100 ±3dB BW (kHz)	Temp Range[1]	Package
Very High Accuracy	INA120	1, 10, 100, 1000	0.5	30	±0.01	96	±(0.25 ± 10/G)	20	Ind	DIP
	INA104P	1–1000[2]	0.15	22	±0.003	96	±(0.25 ± 10/G)	25	Com	DIP
	INA104M	1–1000[2]	0.15	22[3]	±0.003	96	±(0.25 ± 10/G)	25	Ind	DIP
	INA101G, M	1–1000[2]	0.03	22[3]	±0.003	96	±(0.25 ± 10/G)	25	Ind, Mil	DIP, TO-100
	INA101P, U	1–1000[2]	0.3	22[3]	±0.007	90	±(2 ± 20/G) typ	25	Com	DIP, SOIC
Low Quiescent Power	INA102G[8]	1, 10, 100, 1000	0.15	15	±0.02	90	±(2 ± 5/G)	3	Ind	DIP
	INA102P, U	1, 10, 100, 1000	0.4	20	±0.05	80	±(5 ± 10/G)	3	Com, Ind	DIP, SOIC
Low Noise, Low Distortion	INA103G	1–1000[2]	0.1	25	±0.004	100	±(0.5 + 10/G) typ	800	Ind	DIP
	INA103P	1–1000[2]	0.25	25	±0.010	90	±(0.5 + 20/G) typ	800	Com	DIP
Fast Settling FET Input	INA110G[8]	1, 10, 100, 200, 500	0.1	20	±0.01	96	±(2 ± 50/G)	470	Ind	DIP
	INA110P, U	1, 10, 100, 200, 500	0.2	6 typ	±0.02	87	±(2 ± 20/G) typ	470	Com	DIP, SOIC
Buffer, Unity-Gain Difference	3627M	1V/V, fixed	0.01[3]	5	±0.001[3]	100	20	800[3]	Ind	TO-99
	INA105M[8]	1V/V, fixed	0.01[3]	5	±0.001[3]	86[5]	10	1000[3]	Ind	TO-99
	INA105P, U	1V/V, fixed	0.025[3]	5	±0.001[3]	72[5]	5 typ	1000[3]	Com	DIP, SOIC
Gain of 10 Difference	INA106M	10V/V, fixed	0.01[4]	10	±0.001[4]	100[5]	2	500[4]	Ind	TO-99
	INA106P	10V/V, fixed	0.025[4]	4 typ	±0.001[4]	86[5]	0.2 typ	500[4]	Com	DIP
High Com. Mode Volt. Difference (200VDC CMV)	INA117G	1V/V, fixed	0.02[3]	10[3]	±0.001[3]	86[5]	20	200[3]	Ind	DIP
	INA117P	1V/V, fixed	0.05[3]	10[3]	±0.001[3]	74[5]	40	200[3]	Com	DIP
4–20mA Loop Receiver	RCV420BG	0.3125V/mA	0.05	25	±0.002	86	25[7]	150	Ind	DIP
	RCV420KP	0.3125V/mA	0.1	50	±0.002	72	50[7]	150	Com	DIP

NOTES: (1) Com = 0°C to +70°C, Ind = –25°C to +85°C, Mil = –55°C to +125°C. (2) Set with external resistor. (3) Unity-gain. (4) Gain = 10. (5) No source imbalance. (6) DC to 60Hz, Gain = 10, 1kΩ unbalanced. (7) RTO. (8) BS 9000 Screening is available.

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PROGRAMMABLE GAIN AMPLIFIERS

Description	Model	Gain Range	Gain Accuracy, G = 100 25°C, max (%)	Gain Drift, G = 100 (ppm/°C)	Non-Linearity G = 100 max (%)	Input Parameters CMR[1] min (dB)	Input Parameters Offset Voltage vs Temp max (µV/°C)	Dynamic Response, G = 100 ±3dB BW (kHz)	Temperature Range[2]	Pkg
Noninverting Input	PGA100G	Gain set word 1, 2, 4, 8...128	0.02	10	±0.005	NA	6 typ	5MHz	Ind	DIP
	PGA102G	Gain set	0.01	20	±0.01		3, G = 100	250	Ind	DIP
	PGA102P	with 2-bit 100	0.02	50	±0.01		3, G = 100	250	Com	DIP
Instrument. Amplifier Input	PGA200G	Gain set word 1, 10, 100, 1000	0.02	10	±0.003	96	0.4, G = 100	30	Ind	DIP
Fast Settling 2µs to 0.01%	PGA202	Gain set word 1, 10, 100, 1000	0.15	60	±0.012	86	±(6 + 120/G)	1000	Ind, Com	DIP
Differential	PGA203	Gain set word 1, 2, 4, 8	0.15	60	±0.012	86	±(6 + 120/G)	1000	Ind, Com	DIP
Differential	3606M	Gain set word 1, 2, 4, 8...1024	0.02	10	±0.004	90, G = 1	±(1 + 20/G)	40	Ind	DIP

NOTES: (1) DC to 60Hz, Gain = 10, 1kΩ unbalanced. (2) Com = 0°C to +70°C, Ind = –25°C to +85°C.

PRECISION TRANSMITTERS

Descrip	Model	Span Untrimmed Error, max (%)	Span Non-linearity, max (%)	Span Temp Drift[1] (ppm/°C)	Input Parameters Offset Voltage Offset Voltage max	Input Parameters Offset Voltage vs Temp max (µV/°C)	Input Parameters CMR, DC, min (dB)	Output Parameters Current Range (mA)	Output Parameters Offset Current Error, max (µA)	Output Parameters FS Output Current Error, max (µA)	Temp Range[2]	Package
Two-Wire	XTR101G[3], L[3]	–5	0.01	±100	±30µV	±0.75	90	4–20	±6	±30	Ind	DIP
	XTR101P, U	–5	0.01	±100	±100µV	±1.5	90	4–20	±19	±60	Ind[4]	DIP, SOIC
Two-Wire RTD Linearity Compensation	XTR103P	–1	0.01	±25	±50	±1	100	4–20	±10	25	Ind[4]	DIP
	XTR103U	–1	0.01	±50	±100	±2	90	4–20	±20	±50	Ind[4]	SOIC
Two-Wire Hi-Z Strain Gage Linearity Compensation	XTR104P	–1	0.01	±25	±50	±1	100	4–20	±10	±25	Ind[4]	DIP
	XTR104U	–1	0.01	±50	±100	±2	90	4–20	±20	±50	Ind[4]	SOIC
Three-Wire and Current Source	XTR110G	0.2	0.005	30	—	—	—	4–20, 0–20, 5–25[5]	±16	±32	Ind	DIP
	XTR110P, U	0.6	0.025	50	—	—	—	4–20, 0–20, 5–25[5]	±64	±96	Com	DIP, SOIC

NOTES: (1) With zero TC span resistor. (2) Com = 0°C to +70°C, Ind = –25°C to +85°C. (3) BS 9000 screening is available. (4) –40°C to +85°C. (5) Many more ranges with appropriate circuit.

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TRANSFORMER-COUPLED AMPLIFIERS

Descrip	Model	Isolation Voltage (V) Cont Peak	Isolation Voltage (V) Pulse/ Test, Peak	Isolation Mode Rejection, typ DC (dB)	Isolation Mode Rejection, typ 60Hz (dB)	Leakage Current at Test Voltage (μA)	Iso Impedance (Ω)	Iso Impedance (pF)	Gain Nonlinearity max (%)	Gain Nonlinearity typ (%)	Voltage Drift (±μV/°C) max	Bias Current max	±3dB Freq (kHz)	Ext Iso Power Req	Temp[1]
High Isolation Voltage	3656G	±3500	±8000	160	125	0.5	10^{12}	6	±0.05	±0.03	5 + (1000/G_1)	100nA	30	No	Ind
Low Cost Self-Powered	ISO212P	±1060	±1697	160	115	2	10^{10}	12	±0.025	±0.015	±30 (±30/G_1)	50nA	1	No	Com

NOTES: The 3656G package is a DIP; the ISO212P package is a SIP. (1) Ind = –25°C to +85°C Com = 0°C to +70°C.

OPTICALLY COUPLED AMPLIFIERS

Descrip	Model	Isolation Voltage (V) Cont Peak	Isolation Voltage (V) Pulse/ Test, Peak	Isolation Mode Rejection, typ DC (dB)	Isolation Mode Rejection, typ 60Hz (dB)	Leakage Current at Test Voltage (μA)	Iso Impedance (Ω)	Iso Impedance (pF)	Gain Nonlinearity max (%)	Gain Nonlinearity typ (%)	Voltage Drift (±μV/°C) max	Bias Current max	±3dB Freq (kHz)	Ext Iso Power Req	Temp[1]
Balanced Current Input	3650G	±2000	±5000	140	120	0.25[2]	10^{12}	1.8	±0.05	±0.02	5	10nA	15	Yes[3]	Ind
Balanced	3652G	±2000	±5000	140	120	0.25[2]	10^{12}	1.8	±0.1	±0.05	25	50nA	15	Yes	Ind
Low Drift Wide BW	ISO100P	750	2500	146[3]	108[3]	0.3	10^{12}	2.5	0.07	0.02	4[3]	10nA	60	Yes	Ind

NOTES: All packages are DIPs. (1) Ind = –25°C to +85°C. (2) At 240V/60Hz. (3) R_{IN} = 10kΩ, Gain = 100.

CAPACITOR COUPLED, HERMETICALLY SEALED AMPLIFIERS

Descrip	Model	Isolation Voltage (V) Cont Peak	Isolation Voltage (V) Pulse/ Test, Peak	Isolation Mode Rejection, typ DC (dB)	Isolation Mode Rejection, typ 60Hz (dB)	Leakage Current at Test Voltage (μA)	Iso Impedance (Ω)	Iso Impedance (pF)	Gain Nonlinearity max (%)	Gain Nonlinearity typ (%)	Voltage Drift (±μV/°C) max	Bias Current max	±3dB Freq (kHz)	Ext Isol Power Req	Temp[1]
1500VAC Isolation	ISO102B	±2121	±4000	160	120	1.0	10^{14}	6	±0.003	±0.002	±250	100μA	70	Yes	Ind
	ISO120B	±2121	±3535[2]	160	115	0.5	10^{14}	2	±0.02	±0.005	±150	50μA	60	Yes	Ind
	ISO122P	±2121	±3394	160	140	0.5	10^{14}	2	±0.02	±0.008	±200	50μA	50	Yes	Com[3]
3500VAC Isolation	ISO106B	±4950	±8000	160	130	1.0	10^{14}	6	±0.025	±0.007	±250	100μA	70	Yes	Ind
	ISO121B	±4950	±5600[2]	160	115	0.5	10^{14}	2	±0.01	±0.005	±150	50μA	60	Yes	Ind

NOTES: All packages are DIPs. (1) Ind = –25°C to +85°C, Com = 0°C to +70°C. (2) Partial discharge voltage. (3) Not hermetic.

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ISOLATION POWER SUPPLIES[1]

Description	Model	Isolation Voltage (V) Cont Peak	Isolation Voltage (V) Pulse/ Test Peak	Input Voltage (VDC) min	Input Voltage (VDC) max	Leakage Current 240VAC 60Hz (μA)	Isolation Impedance (Ω)	Isolation Impedance (pF)	Current, Balanced Loads On All Outputs (mA) Rated	Current, Balanced Loads On All Outputs (mA) Max[1]	Sensitivity To Input Change (V/V)	Temp[2]	Package
Single ±15V Output	700	1500	4200	10	18	1	10^{10}	5	±3–30	±60	1.08	Ind	Mod
	700U	2000	5000	10	18	1	10^{10}	3	±3–30	±60	1.08	Ind	Mod
	PWS725A	2121	4000	7	18	1.2	10^{12}	9	±15	±40	1.15	Ind	DIP
	PWS726A	4950	8000	7	18	1.2	10^{12}	9	±15	±40	1.15	Ind	DIP
Dual ±15V Output	722	4950	8000	5	16	1	10^{10}	6	±3–40	±50	1.13	Ind	Mod
	PWS727	1060	1700	10	18	1.5	10^{12}	8	±15	±30	1.15	Com	Mod
	PWS728	1060	1700	4.5	5.5	1.5	10^{12}	8	±15	±30	3.2	Com	Mod
Quad ±15V Output	710	1000	3100	10	18	1	10^{10}	8	±9.5	±60	1.08	Ind	Mod
Quad ±8V Output	724	1000	3000	5	16	1	10^{10}	6	±3–16	±60	0.63	Ind	Mod
Multiple Output (1–8)	PWS740	2121	4000	7	20	1.5	10^{12}	3	30[3]	60[3]	1.20	Ind	Sys[4]
	PWS745[5]	1060	1700	4.5[6]	18[7]	1.5	10^{12}	8	±15	30	[8]	Ind	Comp
	PWS750	1060	1700	4.5[6]	18[7]	1.5	10^{12}	8	±15	30	[8]	Ind	Comp

NOTES: (1) See complete product data sheet for full specifications, especially regarding output current capabilities. (2) Ind = –25°C to +85°C, Com = 0°C to +70°C. (3) Per channel. (4) 1 TO-3 driver per 8 channels, plus 2 DIPs per channel. (5) PWS745-1 driver may also be used with PWS740 and PWS750 components. (6) 5V operation. (7) 15V operation. (8) 3.2 for 5V operation; 1.15 for 15V operation.

CAPACITOR-COUPLED ISOLATION AMPLIFIER, WITH POWER

Description	Model	Isolation Voltage (V) Cont Peak	Isolation Voltage (V) Pulse/ Test, Peak	Isolation Mode Rejection, typ DC (dB)	Isolation Mode Rejection, typ 60Hz (dB)	Leakage Current at Test Voltage (μA)	Isolation Impedance (Ω)	Isolation Impedance (pF)	Gain Nonlinearity max (%)	Gain Nonlinearity typ (%)	Voltage Drift (±μV/°C) max	Bias Current max	±3dB Freq (kHz)	Temp[1]
1500VAC Input Power	ISO103	2121	3394[2]	160	130	1.0	10^{12}	11	0.025	0.01	400[1]	50μA	20	Ind
1500VAC Output Power	ISO113	2121	3394[2]	160	130	1.0	10^{12}	11	0.02	0.012	400[1]	50μA	20	Ind
2500VAC Input Power	ISO107	3535	8000	160	100	1.2	10^{12}	13	0.025	0.01	400[1]	50μA	20	Ind

NOTES: All packages are DIPs. (1) Ind = –25°C to +85°C. (2) Partial discharge voltage.

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MULTIPLIERS/DIVIDERS

Model	Transfer Function	Error at +25°C max (%)	Temp Coeff (%/°C)	Feed-through (mV)	Offset Voltage (mV)	1% BW (kHz)	Temperature Range[1]	Package
MPY100	$[(X_1 - X_2)(Y_1 - Y_2)/10] + Z_2$	±0.5	0.008	30	7	70	Ind	TO-100
MPY534	$[(X_1 - X_2)(Y_1 - Y_2)/10] + Z_2$	±0.25	0.008	0.05%	2	3MHz	Com	TO-100
MPY600AP	$[(X_1 - X_2)(Y_1 - Y_2)/2] + Z_2$	±0.25	0.02	2	5	10MHz	Ind	DIP
MPY634M	$[(X_1 - X_2)(Y_1 - Y_2)/10] + Z_2$	±0.5	0.015	0.15%	2	10MHz	Ind	TO-100
MPY634P, U	$[(X_1 - X_2)(Y_1 - Y_2)/10] + Z_2$	±2.0	0.03	0.3%	25	10MHz	Ind	DIP, SOIC
AD632	$[(X_1 - X_2)(Y_1 - Y_2)/10] + Z_2$	±0.5	0.01	0.15	15	50	Ind	TO-100

NOTE: (1) Com = 0°C to +70°C, Ind = –25°C to +85°C.

SPECIAL FUNCTIONS

Function	Model	Description	Comments	Temp Range[1]	Pkg
Multifunction Converter	4302	$Y(Z/X)^m$. This function may be used to multiply, divide, raise to powers, take roots and form sine and cosine functions.	Plastic package.	Ind	DIP
	LOG100	K Log (I_1/I_2)	Optimized for log ratio of current inputs. Specified over six decades of input (1nA to 1mA), 55mV total error, 0.25% log conformity.	Com	DIP
Logarithmic Amplifier	4127G	K Log (I_1/I_{REF})	A more versatile part that contains an internal reference and a current inverter. 1% and 0.5% accuracy.	Com	DIP
$\sqrt{\frac{1}{T}\int_0^T E_{IN}^2(t)\,dt}$	4341	True rms-to-DC conversion based on a log-antilog occupational approach. Pin compatible with 4340.	Some external trimming required. Lower cost in plastic package.	Ind	DIP
Switched Integrator	ACF2101	A dual, integrating, transimpedance amplifier that converts an input current to an output voltage by integrating the current for a user-determined period of time. Eliminates large feedback resistor of traditional I-to-V converters.	Includes HOLD and RESET switches and output multiplexer. $V_{OUT} = -\frac{1}{C}\int i_{IN}\,dt$	Ind	DIP

NOTE: (1) Com = 0°C to +70°C, Ind = –25°C to +85°C.

DIVIDER

Model	Transfer Function	Input Range	Accuracy D = 250mV max (%)	Temperature Coefficient (%/°C)	0.5% Bandwidth (kHz)	Rated Output, min	Temp Range[1]	Pkg
DIV100P	10 x N/D	250mVto 10V	0.25	0.2	15	±10V, ±5mA	Ind	DIP

NOTE: (1) Ind = –25°C to +85°C.

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FREQUENCY PRODUCTS

Function	Model	Description	Comments	Temp Range[1]	Pkg
Oscillator	4423	Very low cost in plastic package. Provides resistor programmable quadrature outputs (sine and cosine wave outputs simultaneously available).	Frequency range: 0.002Hz to 20kHz. Frequency stability: 0.01%/°C. Quadrature phase error: ±0.1%.	Com	DIP
Universal Active Filter	UAF42	Provides a complex pole pair. Based on state variable approach; low-pass, high-pass, and bandpass outputs available.	Add only resistors to determine pole location (frequency and Q). Easily cascaded for complex filter responses.	Ind	DIP

NOTE: Com = 0°C to +70°C, Ind = –25°C to +85°C.

VOLTAGE REFERENCE

Model	Output (V)	Min Output (mA)	Max Drift (ppm/°C)	Power Supply (V)	Power Supply (mA)	Temp Range[1]	Pkg
REF10M	±10.00 ±0.005	10	1	+13.5/35	4.5	Com	TO-99
REF101M	±10.00 ±0.005	10	1	+13.5/35	4.5	Com	TO-99
REF102M	±10.00 ±0.0025	10	2.5	+11.4/36	1.4	Ind, Mil	TO-99
REF102P, U	±10.00 ±0.005	10	5	+11.4/36	1.4	Ind	DIP, SOIC

NOTE: (1) Com = 0°C to +70°C. Ind = –25°C to +85°C, Mil = –55°C to +125°C.

CURRENT REFERENCE

Model	Output I (μA)	Compliance Voltage	Drift (ppm/°C)	Comments	Temp Range[1]	Package
REF200M, P, U	Dual 100 ±0.5	2.5V to 40V	25	Includes 0.5% accurate current mirror.	Ind	DIP, TO-99, SOIC

NOTE: (1) Ind = –25°C to +85°C.

DIGITAL-TO-ANALOG CONVERTERS

DIGITAL SIGNAL PROCESSING DIGITAL-TO-ANALOG CONVERTERS

Model	Resolution (Bits)	Linearity Error (%FSR)	Settling Time (ns)	Output Range	Signal-to-Noise + Distortion Ratio (dB)	Total Harmonic Distortion (dB)	Temp Range[1]	Pkg[2]
DSP-Compatible Digital Interface (Single—DSP201, Dual—DSP202):								
DSP201	18	±0.006	—	±3V	86, f_{OUT} = 20kHz	–90	Ind	DDIP
DSP202	18	±0.006	—	±3V	86, f_{OUT} = 20kHz	–90	Ind	DDIP
Ultra-fast Settling, ECL Input:								
DAC65	12	±0.006	35	±1.2V, ±6.35mA	70, f_{OUT} = 1MHz	–68	Com	DDIP
DAC63	12	±0.012	50	±5mA, 0 to –10mA ±0.5V, 0 to +1.5V with external resistor	—	—	Ind	DDIP
DAC650	12	±0.012	5	±1V, ±20mA	64	–65	Com	68-pin gull-wing

NOTES: (1) Com = 0°C to +70°C, Ind = (–25°C to +85°C) or (–40°C to +85°C). (2) DDIP = 0.6" wide DIP.

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INSTRUMENTATION DIGITAL-TO-ANALOG CONVERTERS

Description	Model	Resolution (Bits)	Linearity Error (%FSR)	Settling Time (µs)	Output Range	Temp Range[1]	Pkg[2]	Q, BI[3] Screen
Dual 12-Bit	DAC2814	12	±0.012	3.5	±10V	Ind	DDIP	—
	DAC2815	12	±0.012	3.5	±10V	Ind	DDIP	—
	DAC4814	12	±0.012	3.5	±10V	Ind	DDIP	—
	DAC4815	12	±0.012	3.5	±10V	Ind	DDIP	—
Very High Resolution	DAC729	18	±0.00075	5	±1mA, –2mA; +5V, +10V, ±5V, ±10V	Com	DDIP	BI
General Purpose	DAC700	16	±0.0015	1	–2mA	Com, Ind, Mil	DDIP	Q, BI
	DAC701	16	±0.0015	8	10V	Com, Ind, Mil	DDIP	Q, BI
	DAC702	16	±0.0015	1	±1mA	Com, Ind, Mil	DDIP	Q, BI
	DAC703	16	±0.0015	8	±10V	Com, Ind, Mil	DDIP, SO	Q, BI
Lowest Cost	DAC1600	16	±0.0015	8 typ	±10V	Com	DDIP	—
Low DLE	DAC710	16	±0.015	8 typ	±1mA	Com	DDIP	—
Around Zero	DAC711	16	±0.015	8 typ	±10V	Com	DDIP	—
Bus Interface:								
16-Bit Parallel	DAC707	16	±0.003	8	±10V	Com, Ind, Mil	DDIP	Q, BI
Serial/8-bit Parallel	DAC708	16	±0.003	1	±1mA, –2mA	Com, Ind, Mil	DDIP	Q, BI
Serial/8-bit Parallel	DAC709	16	±0.003	8	±5V, ±10V, +10V	Com, Ind, Mil	DDIP	Q, BI
Dual, Ser./8-bit Par.	DAC725	16	±0.003	8	±10V	Com, Ind, Mil	DDIP	BI
Industry Standard,	DAC70BH	16	±0.003	1	±1mA, –2mA	Ind	DDIP	BI
General Purpose	DAC71	16	±0.003	8	±1mA, –2mA; +10V, ±10V	Com	DDIP	BI
	DAC72BH	16	±0.003	1	"	Ind	DDIP	BI
Industry Standard	DAC7541A	12	±0.012	1	0 to 1mA	Com, Ind, Mil	DIP, SO	Q, BI
Ind. Std. w/Latch	DAC7545	12	±0.012	2	0 to 1mA	Com, Ind, Mil	DIP, SO	BI
Dual w/Bus Interface:								
Serial Input	DAC7800	12	±0.012	0.8	0 to 1mA	Com	DIP, SO	—
8-bit Port Interface	DAC7801	12	±0.012	0.8	0 to 1mA	Com	DIP, SO	—
12-bit Port Interface	DAC7802	12	±0.012	0.8	0 to 1mA	Com	DIP, SO	—
Flexible Bus Interface:								
Industry Standard Pinout	DAC667	12	±0.006	4	±2.5V, ±5V, ±10V +5V, +10V	Com, Ind, Mil	DDIP, SO	—
	DAC811	12	±0.006	4	±5V, ±10V, +10V	Com, Ind, Mil	DDIP, SO	BI
Small, Low Cost	DAC813	12	±0.006	4	±5V, ±10V, +10V	Com, Ind, Mil	DIP, SO	—
Lowest Cost	DAC1201	12	±0.018	4 typ	±5V, ±10V, +10V	Com	DDIP	—
Industry Standard General Purpose	DAC80	12	±0.012	0.3, 3 typ	±1mA, –2mA; +5V, +10V, ±5V, ±10V	Com	DDIP	BI
	DAC85H	12	±0.012	"	"	Ind	DDIP	Q, BI
	DAC87H	12	±0.012	"	"	Mil	DDIP	Q, BI

NOTES: (1) Temperature Range: Com = 0°C to +70°C, Ind = (–25°C to +85°C) or (–40°C to +85°C), Mil = –55°C to +125°C. (2) DIP = 0.3" wide DIP, DDIP = 0.6" wide DIP, SO = small outline surface mount. (3) Q indicates that optional reliability screening is available for the model. BI indicates that an optional 160 hour burn-in is available for the model.

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AUDIO AND COMMUNICATIONS DIGITAL-TO-ANALOG CONVERTERS

Model	Resolution (Bits)	Max THD + N (V_{OUT} = FS)	Output Range	Input Format	Power Supply (V)	Package[1]	Power Dissipation (mW)
PCM53	16	–88dB (JP), –92dB (KP)	±10V, ±1mA	Parallel	±15, +5	DDIP	600
PCM54	16	–82dB (HP), –92dB (KP), –88dB (JP)	±3V,±1mA	Parallel	±5 to ±12	DDIP	300
PCM55	16	–82dB (HP), –88dB (JP)	±3V,±1mA	Parallel	±5	SO	125
PCM56	16	–82dB (P), –88dB (P-J), –92dB (P-K)	±3V, ±1mA	Serial, Latched	±5 to ±12	DIP	260
PCM60	16	–82dB (P), –88dB (P-J)	2.8Vp-p, 2-Channel	Seria, Latchedl	+5	SO	50
PCM66	16	–82dB (P)	2.8Vp-p, 2-Channel	Serial, Latched	+5	SO	50
PCM1700	18	–82dB (P), –88dB (P-J), –92dB (P-K)	±3V, ±0.67mA	Serial, Latched	±5	DDIP, SO	380
PCM58	18	–92dB (P), –94dB (P-J), –96dB (P-K)	±1mA	Serial, Latched	+5, –12	DDIP	400
PCM61	18	–82dB (P), –88dB (P-J), –92dB (P-K)	±3V, ±1mA	Serial, Latched	±5 to ±12	DDIP	200
PCM63	20	–88dB (P), –88dB (P-J), –96dB (P-K)	±2mA	Latched	±5	DDIP	200
PCM64	18	–96dB	±1mA	Parallel	+5, –15	DIP	400

NOTES: (1) DIP = 0.3" wide DIP, DDIP = 0.6" wide DIP, SO = small outline surface mount.

ANALOG MULTIPLEXERS

ANALOG MULTIPLEXERS

Description	Model	Channels	Input Range (V)	On Resistance max (Ω)	Settling Time (to 0.01%)	Temp Range[1]	Pkg[2]
Protected Inputs	HI3-0506A-5	16 single ended	±15	1.8k	3.5µs	Com	28-pin PDIP
	HI1-0506A-5	16 single ended	±15	1.8k	3.5µs	Com	28-pin CDIP
	HI1-0506A-2	16 single ended	±15	1.5k	3.5µs	Mil	28-pin CDIP
	HI3-0507A-5	8 differential	±15	1.8k	3.5µs	Com	28-pin PDIP
	HI1-0507A-5	8 differential	±15	1.8k	3.5µs	Com	28-pin CDIP
	HI1-0507A-2	8 differential	±15	1.5k	3.5µs	Mil	28-pin CDIP
	HI3-0508A-5	8 single ended	±15	1.8k	3.5µs	Com	16-pin PDIP
	HI1-0508A-5	8 single ended	±15	1.8k	3.5µs	Com	16-pin CDIP
	HI1-0508A-2	8 single ended	±15	1.5k	3.5µs	Mil	16-pin CDIP
	HI3-0509A-5	4 differential	±15	1.8k	3.5µs	Com	16-pin PDIP
	HI1-0509A-5	4 differential	±15	1.8k	3.5µs	Com	16-pin CDIP
High Speed	MPC800KG	16 single or 8 differential	±15	750	800ns	Com	CDIP
	MPC800SG	16 single or 8 differential	±15	750	800ns	Mil	CDIP
	MPC801KG	8 single or 4 differential	±15	750	800ns	Com	CDIP
	MPC801SG	8 single or 4 differential	±15	750	800ns	Mil	CDIP

NOTES: (1) Temperature range: Com = 0°C to +70°C, Mil = –55°C to +125°C. (2) CDIP = ceramic DIP, PDIP = plastic DIP.

SAMPLE/HOLD AMPLIFIERS

SAMPLE/HOLD AMPLIFIERS

Description	Model	Gain Error (%)	Offset Error (mV)	Charge Offset (mV)	Acquisition Time (µs max)	Droop Rate (µV/ms)	Temp Range[1]	Pkg[2]	Q, BI[3] Screen
Fast, High Accuracy	SHC76	±0.02	±3	±6 typ	3	1	Ind, Com, Mil	HMD	—
Fast, Industry Standard	SHC85	±0.01	±2	±2 max	4.5	125	Com, Mil	HMD	Q
Low Cost, Fast, Indus. Std.	SHC5320	NA	±0.5	±1 typ	1.5	0.5	Com, Mil	HCD	BI
Lowest Cost, Industry Standard	SHC298	±0.01	±7	±25 max	10	100	Com, Ind	PDIP, MC, SOIC	BI

(Continued on next page.)

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HIGH-SPEED SAMPLE/HOLD AMPLIFIERS

Description	Model	Gain Error (%)	Offset Error (mV)	Linearity Error (%FSR max)	Ampl BW –3dB (MHz)	Acq Time (µs max)	Droop Rate (µV/µs)	Temp Range[1]	Input Range (Vp-p)	Pkg[2]	Q[3] Screen
High Speed With Buffer	SHC803	±0.1	±3	±0.005	16	0.35	±5	Ind	20	HDIP	Q
High Speed	SHC804	±0.1	±3	±0.005	16	0.35	±5	Ind	20	HDIP	Q
Ultra-High Speed	SHC600	±0.1	±5	±0.01	70	0.05	±180	Ind	2.5	CDIP	Q
	SHC601	±2	±50	±0.02	100	0.022	±100	Ind	2.5	CDIP	Q
Very High Accuracy, Fast	SHC702	±0.1	±3	±0.003 typ	3	0.8	±2	Ind	20	24-pin DIP	—

NOTES: (1) Temperature range: Com = 0°C to +70°C, Ind = –25°C to +85°C, Mil = –55°C to +125°C. (2) MC = metal can, PDIP = plastic DIP, HCD = hermetic ceramic DIP, CD = ceramic DIP, HMD = hermetic metal DIP, SOIC = surface-mount package. (3) Q indicates optional reliability screening is available for this model. BI indicates that an optional 160-hour burn-in is available for the model.

ANALOG-TO-DIGITAL CONVERTERS

INSTRUMENTATION ANALOG-TO-DIGITAL CONVERTERS

Description	Model	Resolution (Bits)	Linearity Error (%FSR)	Input Range (V)[1]	Conv. Time or Sampling Rate (µs)	NMC Resolution	Temp Range[2]	Package[3]	Q, BI[4] Screen
Data-Bus Interface	ADC700	16	±0.003	5, 10, 20 U/B	17	14	Mil, Ind, Com	TDIP	—
Industry Std Pinouts	ADC71	16	±0.003	5, 10, 20 U/B	50	14	Ind, Com	TDIP	—
	ADC76	16	±0.003	5, 10, 20 U/B	17	14	Ind, Com	TDIP	—
Sampling 574 Type	ADS574	12	±0.012	10, 20, U/B	40kHz	12	Ind	DIP, DDIP, SO	—
Sampling 774 Type	ADS774	12	±0.012	10, 20, U/B	100kHz	12	Ind	DIP, DDIP, SO	—
Sampling, Interface	ADS7800	12	±0.012	10, 20, B	333kHz	12	Com, Ind	DIP, SO	
Hi-Accuracy, 4-Chan. Auto-Calibration	ADC7802	12	±0.012	0 to +5	8.5	12	Ind	DDIP, PLCC	—
Hi-Accuracy, 4-Chan. Auto-Calibration, Sampling	ADS7803	12	±0.012	0 to 5 U	8.5	12	Ind	DDIP, PLCC	—
Industry Std Pinout and Interface	ADC574A	12	±0.012	10, 20 U/B	25	12	Mil, Ind, Com	DDIP, PLCC	BI
	ADC674A	12	±0.012	10, 20 U/B	15	12	Mil, Ind, Com	DDIP	BI
	ADC774	12	±0.012	10, 20 U/B	8	12	Mil, Ind, Com	DDIP, PLCC	BI
Sampling	ADS807	12	±0.012	10, 20 U/B	100kHz	12	Mil, Ind, Com	DDIP	BI
	ADS808	12	±0.012	10, 20 U/B	100kHz	12	Mil, Ind, Com	DDIP	BI
Medium Speed Monolithic	ADC80AG	12	±0.012	5, 10, 20 U/B	25	12	Ind	TDIP	BI
	ADC80MAH	12	±0.012	5, 10, 20 U/B	25	12	Ind	TDIP	BI
Medium Speed	ADC84KG	12	±0.012	5, 10, 20 U/B	10	12	Ind	TDIP	BI
	ADC85H	12	±0.012	5, 10, 20 U/B	10	12	Com	TDIP	Q, BI
Mil Temp Range	ADC87H	12	±0.012	5, 10, 20 U/B	10	12	Mil	TDIP	Q
Serial Output	ADC804	12	±0.012	5, 10, 20 U/B	17	12	Mil, Ind, Com	DDIP	Q, BI

NOTES: (1) U/B indicates the input voltage range for the model: U = unipolar, B = bipolar. (2) Com = 0°C to +70°C, Ind = –25°C to +85°C, Mil = –55°C to +125°C. (3) DIP = 0.3" wide DIP, DDIP = 0.6" wide DIP, TDIP = 0.9" wide DIP, PLCC = plastic leaded chip carrier, SO = small outline surface mount. (4) Q indicates optional reliability screening is available for this model. BI indicates that an optional 160-hour burn-in is available for this model.

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AUDIO, COMMUNICATIONS, DSP ANALOG-TO-DIGITAL CONVERTERS

Description	Model	Resolution (Bits)	Linearity Error, max (%FSR)	Input Range (V)	Conversion Time or Sampling Rate (µs)	THD (dB, typ)	Temp Range[1]	Pkg[2]
High Accuracy, High Resolution	ADC701	16	±0.003	10V/20V	1.5	94w/SHC702	Com	TDIP
Sampling, High Resolution	ADC614	14	±0.003	±1.25	5.12MHz	–88	Com	DIP
	ADC603	12	±0.018	±1.25	10MHz	–68	Com, Mil	DIP
High Spurious-Free Range	ADC604	12	±0.024	±1.25	5MHz	83	Com	DIP
	ADC803	12	±0.012	10V/20V	1.5	NA	Ind, Mil	TDIP
	ADC601	12	±0.012	10V/20V	1.0	70w/SHC802	Com	TDIP
Sampling	ADS602	12	±0.03	10V/20V	1MHz	66	Com	TDIP

Description	Model	Resolution (Bits)	Typical Linearity Error	Input Range (V)	Conv. Time or Sampling Rate (µs)	THD + N (V_{IN} = ±FS) (dB, max)	Output Format	Pkg[2]
High Performance	PCM75	16	15-Bit 14-Bit	±2.5, ±5 ±10V	17	–84 (J) –88 (K)	Parallel or Serial	TDIP
Low Cost	PCM78	16	14-Bit	±3	5	–88	Serial	DDIP
Dual	PCM1750	18	14-Bit	±2.75	5	–90 (P)	Serial	DDIP
Single Channel	DSP101	18	14-Bit	±2.75	5	–90	Serial	DDIP
Dual Channel	DSP102	18	14-Bit	±2.75	5	–90	Serial	DDIP

NOTES: (1) Com = 0°C to +70°C, Ind = –25°C to +85°C, Mil = –55°C to +125°C. (2) DIP = 0.3" wide DIP, DDIP = 0.6" wide DIP, TDIP = 0.9" wide DIP, PLCC = plastic leaded chip carrier, SO = small outline surface mount.

VOLTAGE-TO-FREQUENCY CONVERTERS

Description	Model	Frequency Range (kHz)	V_{IN} Range (V)	Linearity, max (% of FSR)	Tempco, max (ppm of FSR/°C)	Temp Range[1]	Package
Low-Cost Monolithic	VFC32P, U VFC32M	User-selected 500kHz, max	User-selected	±0.01 at 10kHz ±0.05 at 100kHz	75 typ ±100	Com Ind	DIP, SOIC TO-100
Low-Cost Complete	VFC42 VFC52	0 to 10 0 to 100	0 to +10 0 to +10	±0.01 ±0.05	±100 ±150	Ind Ind	DIP DIP
Precision Monolithic	VFC62 VFC320	User-selected	User-selected 1MHz max	±0.002 at 10kHz ±0.002 at 10kHz	±20 ±20	Ind Ind	DIP TO-100, LCC
Synchronized Monolithic	VFC100G	Clock-Programmed 2MHz max,	0 to +10	0.1 at 1MHz	±50	Ind	DIP
	VFC101N	Clock-Programmed, 2MHz max	0 to +10,	±0.02 at 100kHz	±40	Ind	PLCC
High-Performance	VFC110	User-selected 4MHz max	0 to +10	±0.05 at 1MHz	±50	Ind	DIP, LCC
Single Supply, Low Power	VFC121	User-selected 1.5MHz max	User selected	±0.03 at 100kHz	±40	Ind	DIP

NOTES: (1) Com = 0°C to +70°C, Ind = –25°C to +85°C.

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DIGITAL SIGNAL PROCESSING COMPONENTS

ANALOG DSP COMPONENTS AND TEST SYSTEMS

Function	Model	Description	Sample Rate	Resolution	Package
Analog-to Digital Converters	DSP101	Low-cost, high resolution A-to-D with zero-chip interface to DSP ICs from ADI, AT&T, Motorola and TI.	200kHz	16/18 bits	28-pin DIP
	DSP102	Two-channel, low-cost, high resolution A-to-D with zero-chip interface to DSP ICs from ADI, AT&T, Motorola and TI.	200kHz	16/18 bits	28-pin DIP
Digital-to-Analog Converters	DSP201	Low-cost, high resolution D-to-A with zero-chip interface to DSP ICs from ADI, AT&T, Motorola and TI.	500kHz	16/18 bits	28-pin DIP
	DSP202	Two-channel, low-cost, high resolution D-to-A with zero-chip interface to DSP ICs from ADI, AT&T, Motorola and TI.	500kHz	16/18 bits	28-pin DIP
Analog Input DSP	DSP-SYS603	Complete test system including A-to-D box, digital buffer, DSP processor, and software, designed to run on a PC.	10MHz	12 bits	Hardware and Software
Text Systems	DSP-SYS701	Complete test system including A-to-D box, digital buffer if required, DSP processor, and software, designed to run on a PC.	500kHz	16 bits	Hardware and Software

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DSP PROCESSOR BOARDS

Model	Processor	Quantity	Speed (ns)	SRAM (KB)	DRAM (MB)	Board Form	1024-FFT Execution Time (ms)	FIR Filter Tap Execution Time (ns)	IIR B-Quad Filter Execution Time (µs)
ZPB34-001	AT&T DSP32C	1	80	64	—	PC/AT	3.2	80	0.4
ZPB34-002	AT&T DSP32C	1	80	192	—	PC/AT	3.2	80	0.4
ZPB34-003	AT&T DSP32C	1	80	320	—	PC/AT	3.2	80	0.4
ZPB34-004	AT&T DSP32C	1	80	576	—	PC/AT	3.2	80	0.4
ZPB3201	AT&T DSP32	1	160	64	—	VME 6U	5.7	160	0.8
ZPB3202	AT&T DSP32	2	160	128	—	VME 6U	5.7	160	0.8
ZPB3211	AT&T DSP32C	1	80	64	—	VME 6U	3.2	80	0.4
ZPB3212	AT&T DSP32C	2	80	128	—	VME 6U	3.2	80	0.4
ZPB3401-001	AT&T DSP32C	1	80	256	1	VME 6U	3.2	80	0.4
ZPB3401-002	AT&T DSP32C	1	80	256	4	VME 6U	3.2	80	0.4
ZPB3402-001	AT&T DSP32C	2	80	512	1	VME 6U	3.2	80	0.4
ZPB3402-002	AT&T DSP32C	2	80	512	4	VME 6U	3.2	80	0.4
ZPB3403-001	TI TMS320C31	1	60	256	1	VME 6U	3.04	60	0.3
ZPB3403-002	TI TMS320C31	1	60	256	4	VME 6U	3.04	60	0.3
ZPB3404-001	TI TMS320C31	2	60	512	1	VME 6U	3.04	60	0.3
ZPB3404-002	TI TMS320C31	2	60	512	4	VME 6U	3.04	60	0.3

DSP ANALOG I/O SYSTEMS

Model	Form	Analog Input Channels	Analog Output Channels	Number of Bits	Max Conversion Rate	Anti-Aliasing Filter	Smoothing Filter	On-Board Sample Rate Generator
ZPB100	PC Board	1	1	16	8kHz	300Hz–3kHz	0Hz–3kHz	8kHz
ZPB1008	PC Board	8		12	8kHz	2-Pole	—	Programmable
ZPB1100	PC Board	1		16	150kHz	User-Specified	—	75Hz–150kHz
ZPB2100	PC Board		1	16	150kHz	—	User-Specified	—
ZPD1001	External Box	1 or 2	1 or 2	16	150kHz	—	—	4.8kHz–150kHz
ZPD1002	External Box	1 or 2		12	10MHz	—	—	—
ZPD1003	External Box	1		16	500kHz	—	—	—
ZPD1004	External Box	1 or 2		12	5MHz	—	—	—
ZPD1005	External Box	1 or 2		14	5MHz	—	—	—
ZPD1007	External Box	2	2	16, 18	200kHz (I), 500kHz (O)	6-Pole	6-Pole	Programmable

DOS-BASED DSP SOFTWARE

Model	Function
ZPA1000	Emulates three test instruments for signal analysis: oscilloscope, spectrum and histogram analyzers.
ZPM50-001 (*DSPlay*™)	DSP algorithm development and simulation.
ZPM32 (*DSPlay* XL™)	DSP algorithm development and code generation for DSP32/DSP32C
ZPO32	AT&T DSP32/32C assembler.
ZPO33	AT&T DSP32-CC "C" compiler.
ZPOFDAS1/DAS2	Momentum Data's filter design.

DSPlay™, *DSPlay* XL™ Burr-Brown Corp.

Burr-Brown

CATALYST SEMICONDUCTOR
2231 Calle de Luna, Santa Clara, CA 95054 Tel: 408-748-7700 Telex: 5106017631 Fax: 408-980-8209

PRODUCT SELECTION GUIDE

2-Wire Bus Structure

Device	Temp Range	Compatibility	Size (Organization)	Icc (Max/Standby)	Max Clock Freq.	# Pins	Pkg Types	Availability	
CAT24C02	C,I	Xicor	2K Bit	3mA/4µA	100KHz	8 14	P,J J	NOW	
CAT24LC02	C,I	Xicor	2K Bit	3mA/4µA	100KHz	8 14	P,J J	NOW	3-6Volt
CAT24C04	C,I	Xicor	4K Bit	3mA/4µA	100KHz	8 14	P,J J	4Q91	
CAT24LC04	C,I	Xicor	4K Bit	3mA/4µA	100KHz	8 14	P,J J	4Q91	3-6Volt
CAT24C08	C,I	Xicor	8K Bit	3mA/4µA	100KHz	8 14	P,J J	4Q91	
CAT24LC08	C,I	Xicor	8K Bit	3mA/4µA	100KHz	8 14	P,J J	4Q91	3-6Volt
CAT24C16	C,I	Xicor	16K Bit	3mA/4µA	100KHz	8 14	P,J J	4Q91	
CAT24LC16	C,I	Xicor	16K Bit	3mA/4µA	100KHz	8 14	P,J J	4Q91	3-6Volt

All I^2C devices offered in ZERO Power™ (I_{SB}=OµA) version. High Endurance ("H") is standard for I^2C devices.
Catalyst Semiconductor is licensed by Philips Corporation to carry the I^2C Bus Protocol.

3-Wire Bus Structure

Device	Temp Range	Compatibility	Size (Organization)	Icc (Max/Standby)	Max Clock Freq.	# Pins	Pkg Types	Availability	
CAT93C46A	C I	National 9346	1K Bit (64x16)	3mA/100µA 4mA/100µA	700KHz	8	P,K	NOW	
CAT93C46	C I	National 9346	1K Bit (x8 or x16)	3mA/100µA 4mA/100µA	700KHz	8	P,K,J	NOW	
CAT33C101	C, I	National 9346 UPGRADE	1K Bit (x8 or x16)	2mA/50µA	700KHz	8	P,K,J	NOW	3Volt
CAT32C101	C,I	National 9346 UPGRADE	1K Bit (x8 or x16)	1.0mA/2µA	250KHz	8	P,K	NOW	2Volt
CAT93C56	C I	National 93C56	2K Bit (x8 or x16)	3mA/100µA 4mA/100µA	1MHz	8	P,K	NOW	
CAT93LC56	C, I	National 93C56 UPGRADE	2K Bit (x8 or x16)	2mA/50µA	250KHz	8	P,K	NOW	3Volt
CAT35C102	C I	National 9346 UPGRADE	2K Bit (x8 or x16)	3mA/100µA 4mA/100µA	1MHz	8	P,K	NOW	
CAT33C104	C,I	National 93C66 UPGRADE	4K Bit (x8 or x16)	2mA/50µA	250KHz	8	P,K	NOW	3Volt
CAT35C104	C I	National 93C66	4K Bit (x8 or x16)	3mA/100µA 4mA/100µA	1MHz	8	P,K	NOW	
CAT33C116	C,I	National 9346 UPGRADE	16K Bit (x8 or x16)	2mA/50µA	250KHz	8	P,K	1Q92	3Volt
CAT35C116	C,I	National 9346 UPGRADE	16K Bit (x8 or x16)	3mA/100µA	1MHz	8	P,K	1Q92	

4-Wire Bus Structure

Device	Temp Range	Compatibility	Size (Organization)	Icc (Max/Standby)	Max Clock Freq.	# Pins	Pkg Types	Availability	
CAT59C11	C,I	G.I. 5911	1K Bit (x8 or x16)	5mA/100µA	250KHz	8	P,K	NOW	
CAT33C201	C, I	G.I. 5911 UPGRADE	1K Bit (x8 or x16)	2mA/50µA	700KHz	8	P,K	NOW	3Volt
CAT35C202	C I	G.I. 5911 UPGRADE	2K Bit (x8 or x16)	3mA/100µA 4mA/100µA	1MHz	8	P,K	NOW	

All Serial E^2PROMs offered in High Endurance version ("H").

Device	Temp Range	Size (Organization)	Access Time (ns)	Icc (Max/Standby)	# Pins	Pkg Types	Availability	
CAT28C16A	C,I	16K Bit (2Kx8)	200	25mA/100µA	24	P	NOW	
CAT28C16V3	C,I	16K Bit (2Kx8)	700	10mA/50µA	24 32	K N	NOW	3Volt
CAT28C17A	C,I	16K Bit (2Kx8)	200	25mA/100µA	28 32	P,K N	NOW	
CAT28C64A	C,I	64K Bit (8Kx8)	150/200/250	30mA/100µA	28 32	P,D,J N	NOW	
CAT28C65A	C,I	64K Bit (8Kx8)	150/200/250	30mA/100µA	28	P	NOW	
CAT28C256	C,I	256K Bit (32Kx8)	200/250/300	30mA/150µA	28 32	P,D N	NOW	

FLASH MEMORIES

Device	Temp Range	Size (Organization)	Access Time (ns)	Icc (Max/Standby)	# Pins	Pkg Types	Availability
CAT28F010	C	1M Bit (128Kx8)	120/150/200	30mA/100µA	32	P,N	4Q91
CAT28F512	C	512K Bit (64Kx8)	200/250	50mA/500µA	32	P,N	4Q91
CAT28F512V5	C	512K Bit (64Kx8)	200/250	120mA/100µA	32	P,N	4Q91

EPROM

Device	Temp Range	Size (Organization)	Access Time (ns)	Icc (Max/Standby)	# Pins	Pkg Types	Availability
CAT27HC256	C	256K Bit (32Kx8)	55/70/90/120	60mA/40mA	28	P (OTP)	NOW
	I,M		70/90/120	80mA/45mA	28	D	
CAT27HC256L	C		70/90/120	60mA/500µA	32	E	
	I,M		70/90/120	80mA/1mA	32	N(OTP)	
CAT27C210	C	1M Bit (64Kx16)	150/170/200/250	50mA/100µA	40	D,P (OTP)	NOW
	I,M		170/200/250	60mA/100µA	44	N (OTP)	

STATIC RAMS

Device	Temp Range	Size (Organization)	Access Time (ns)	Icc (Max/Standby)	# Pins	Pkg Types	Availability
CAT71C256L-85	C,I	256K Bit (32Kx8)	85	80mA/100µA	28	P,K	NOW

NVRAMS

Device	Temp Range	Compatibility	Size (Organization)	Icc (Max/Standby)	Access Time (ns)	# Pins	Pkg Types	Availability
CAT22C10	C,I	Xicor	256 Bit (64x4)	40mA/30µA	200/300	18	P	NOW
						20	J	
CAT22C12	C,I	Xicor	1K Bit (256x4)	50mA/30µA	200/300	18	P	NOW
CAT24C44	C,I	Xicor	256 Bit (16x16) Serial	20mA/30µA	1MHz	8	P	NOW
						8	J	

NONVOLATILE SERIAL EEPROMS

Device	Protocol	Size (Organization)	Temp Range	Icc (Max/Standby)	Max Clock Freq.	# Pins	Pkg Types	Availability	
CAT33C704	Synchronous	4K Bit (x8 or x16)	C,I	3mA/200µA	1 MHz	8	P	NOW	3Volt
CAT35C704			C,I	3mA/200µA	3 MHz			NOW	
CAT33C804	UART Compatible		C,I	3mA/200µA	5 MHz	16	J	NOW	3Volt
CAT35C804			C,I	3mA/200µA	5 MHz			NOW	

ORDERING INFORMATION

Prefix	Device #	Suffix		
CAT	28C64A	P	I	-20

Device Part Number may be followed by:
- A = Advanced Device or Special Assembly
- H = High Endurance ★
- L = Low Power Device
- V = Special Voltage
- Z = Zero Power

Package
- C = Sidebraze
- D = CERDIP
- E = LCC
- J = S.O. (JEDEC)
- K = S.O (EIAJ)
- N = PLCC
- P = Plastic DIP

Temperature Range
- Blank = Commercial (0°C to 70°C)
- I = Industrial (-40°C to 85°C)
- M = Military (-55°C to 125°C)

Speed or Program Number (if applicable)

Device used in the example above is a CAT28C64API-20 (Plastic DIP, Industrial temp., 200ns access time).

★ High Endurance Device: minimum 100,000 write/erase cycles and 100 year data retention.

FOR INFORMATION ON OTHER MILITARY TEMPERATURE DEVICES, please contact the factory.

Catalyst Semiconductor

CIRRUS LOGIC

CL-CD2400/2401

Data Sheet

Four-Channel, Multi-Protocol Communications Controller

FEATURES

General

- Four full-duplex channels
- All channels support async, bisync, HDLC, and X.21 protocols
- Bit rates to 64 kbit transmit and receive NRZ, NRZI, and Manchester data encoding supported
- Digital phase locked loop on each receiver
- Independent bit rate generators for transmit and receive
- Clock sources can be internal or external
- Transmit clock source can be receive DPLL output
- Full on-chip DMA controller
- Data transfer by DMA or Interrupt mechanism selectable per channel per direction
- Vectored interrupts with Fair Share™ mechanism for cascading

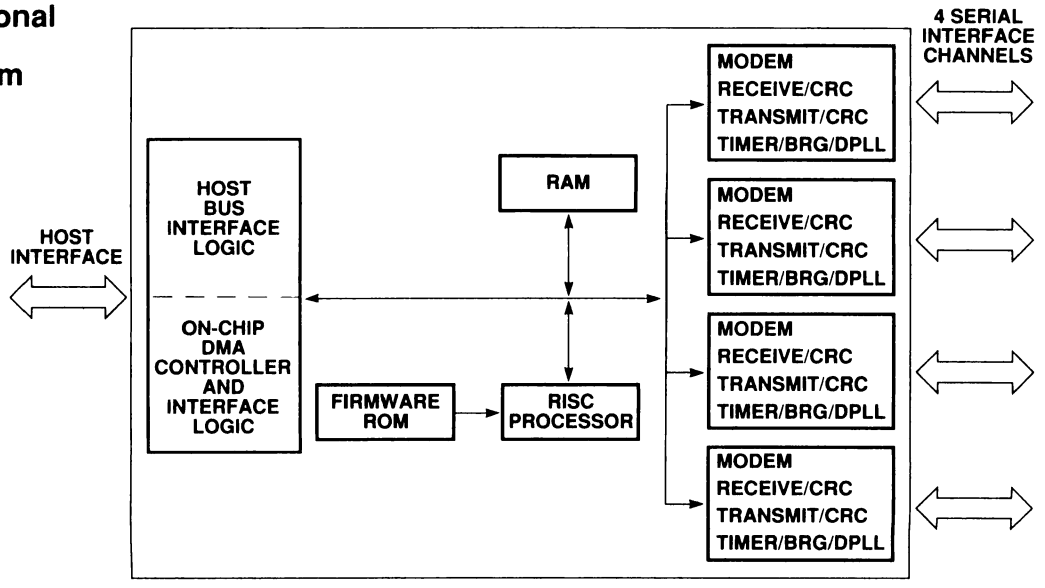
OVERVIEW

The CL-CD2400 is a synchronous/asynchronous communications controller featuring full on-chip DMA for each channel in each direction. Combining the DMA and protocol controllers enables a more efficient host interface to be provided for both synchronous and asynchronous modes. An efficient vectored interrupt scheme is also provided to minimize host processing overhead and share service fairly among channels and cascaded devices.

By providing the ability to simultaneously use more than one buffer area and to add data to existing buffers, efficient DMA control of data transfer can be achieved.

Cirrus Logic

Functional Block Diagram



FOR MORE INFORMATION, CONTACT:

CIRRUS LOGIC, INC., 3100 W. Warren Ave., Fremont, CA 94539 510/623-8300

FEATURES

Asynchronous Features

- **Software-programmable serial data rates up to 115.2 Kbit/sec. full-duplex[1]**
- **Twelve bytes of FIFO for each transmitter and each receiver, with programmable threshold for receive-FIFO-interrupt generation**
- **Improved interrupt schemes: *Good Data*™ *Interrupt*s eliminate the need for character status check**
- **Independent bit rate selection for transmit and receive on each channel**
- **User-programmable and automatic flow control modes for the serial channels:**
  - — In-band (software) flow control via single character (XON/XOFF)
  - — Out-of-band (hardware) flow control via RTS/CTS and DTR/DSR
- **Special character recognition and generation**

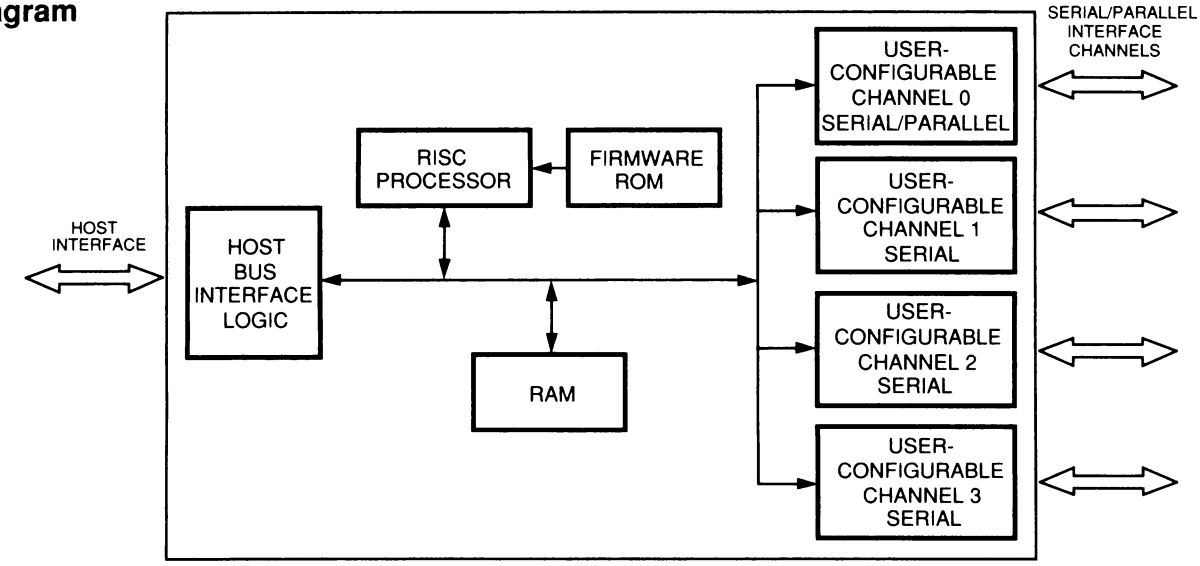
Four-channel Serial/Parallel Communications Engine with UNIX® Character Processing

OVERVIEW

The CL-CD1400 is a flexible asynchronous receiver/transmitter with four full-duplex serial channels, or three full-duplex serial channels and one high-speed bidirectional parallel channel. With optional special character processing capabilities, it is especially well-suited to UNIX applications. The CL-CD1400 is fabricated in an advanced-CMOS process and operates on a system clock of up to 20.2752 MHz.[2] Packaged in a 68-pin PLCC, the device offers high throughput, low-power consumption and a high level of integration to permit system designs with minimum part-count, maximum performance and maximum reliability.

Cirrus Logic

Functional Block Diagram



FOR MORE INFORMATION, CONTACT:
CIRRUS LOGIC, INC., 3100 W. Warren Ave., Fremont, CA 94539 510/623-8300

CIRRUS LOGIC

CL-GD5410

Preliminary Data Sheet

FEATURES

- **100% hardware- and BIOS-compatible with IBM® VGA display standards**
- **Motherboard VGA solution with only 3 ICs**
- **High-performance, dual-FIFO architecture**
- **Resolutions up to 1024 x 768**
  - — 1024 x 768 x 16 and 256 colors interlaced and non-interlaced
  - — 800 x 600 x 16, 256, 32,768 and 65,536 colors
- **Integrated RAMDAC and Dual-Frequency Synthesizer**
- **Up to 1 Mbyte of display memory**
  - — 8-, 16- or 32-bit display memory bus
- **x4-, x8-, x16-wide DRAMs**
- **Dot clock up to 65 MHz**
- **ISA (up to 12.5 MHz), E-ISA, MCA bus interfaces**
- **8- or 16-bit host bus interface**
- **Built-in feature connector support (VESA/VGA pass-through connector)**
- **100- and 132-column text modes**
- **Video Subsystem Enable: 3C3 and 46E8 sleep mechanism**
- **Low-power CMOS, 160-pin QFP package**

Cirrus Logic

High-Resolution VGA Graphics Controller

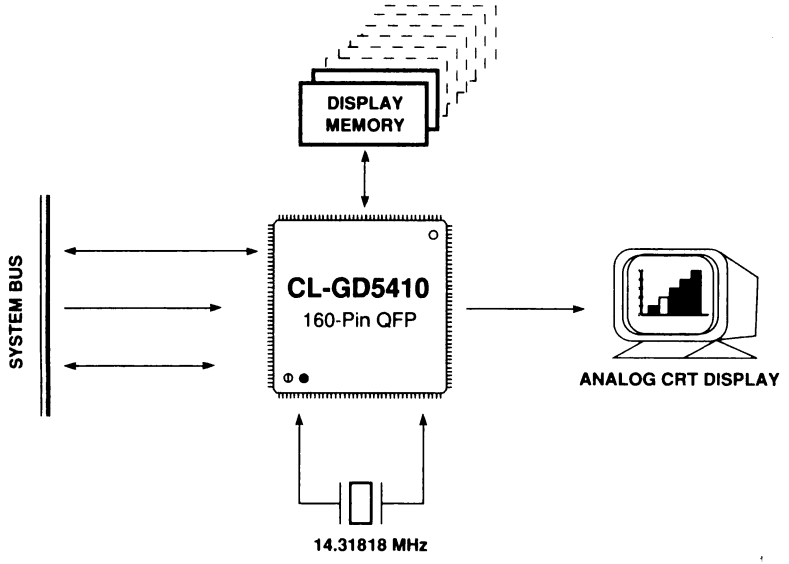
OVERVIEW

The single-chip CL-GD5410 VGA graphics controller is hardware-compatible with the IBM VGA standard and provides improved performance with additional functionality.

Ideally suited to highly integrated systems, the CL-GD5410 requires no external support other than display memory and a 14.31818 MHz frequency reference. A motherboard VGA solution supporting 1024K bytes can be achieved with two DRAMs. The CL-GD5410 connects directly to an ISA, E-ISA or MCA bus, allowing a minimum adapter solution of five ICs.

Operating at dot clock rates up to 65 MHz, the CL-GD5410 chip supports standard resolutions to 1024 by 768 at up to eight bits per pixel (256 simultaneous colors). The internal RAMDAC may be configured as an industry-standard RAMDAC to provide a palette of 262,144 colors.

System Block Diagram



FOR MORE INFORMATION, CONTACT:
CIRRUS LOGIC, INC., 3100 W. Warren Ave., Fremont, CA 94539 510/623-8300

CIRRUS LOGIC

CL-CD180

Data Sheet

FEATURES

Performance Enhancement Features:

- 8 full-duplex asynchronous channels
- Baud rates to 38.4K baud per transmitter and receiver
- On-chip scanner for handling channel interrupts
- 24-bytes of FIFO for each channel consisting of:
  - 8-byte transmit FIFO
  - 8-byte receive FIFO with programmable threshold
  - 8-byte status FIFO
- Improved interrupt schemes:
  - Vectored interrupts to allow direct jump into proper service routines
  - *Good data interrupts* to eliminate the need for status checks
  - *Fair share interrupts* to ensure equal service for all channels
  - External user-defined priorities
- User-programmable and automatic flow control modes
  - In-Band (software) via single or double character Xon, Xoff
  - Out-of-Band (hardware) via RTS/CTS, DTR/DSR
- Special character recognition and generation
- Line break detection and generation
- Cascadable to multiple CL-CD180s using Fair Share daisy chain scheme
- Insertion of transmit delays in data stream
- Baud rate selection via loading a divisor
- One timer per channel for receive data interrupt generation

Intelligent Octal-Channel Asynchronous Communications Controller

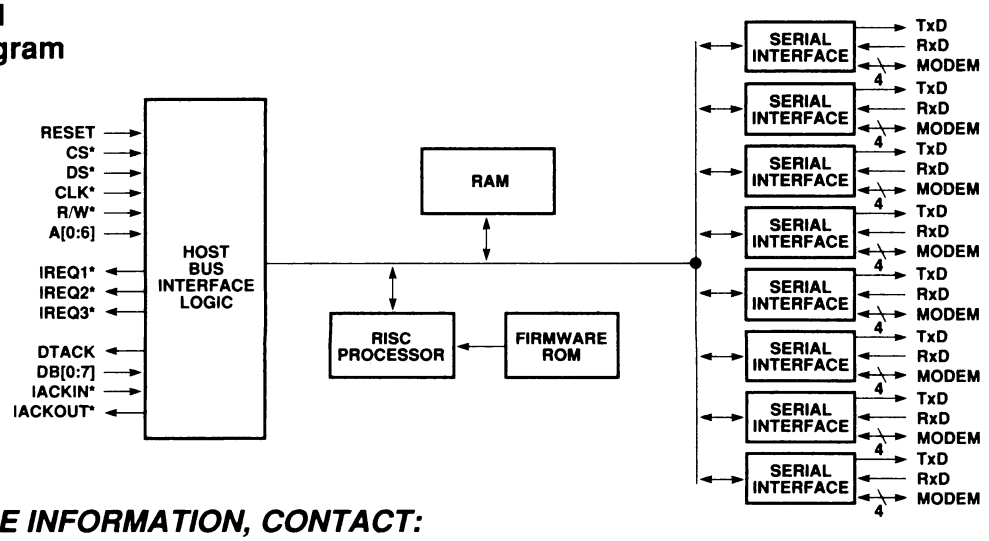
OVERVIEW

The CL-CD180 is an intelligent asynchronous controller capable of supporting eight full duplex channels that transfer data simultaneously at 38.4 Kbps. The controller is unique because it can move data efficiently from the channels to the host, resulting in a multi-fold improvement in system-level throughput. The CL-CD180 feature set is developed to specifically handle the system-level performance bottlenecks of data throughput and real-time tasking.

To increase the overall data throughput of the system, special features such as on-chip scanner, on-chip data buffering and programmable receive FIFO thresholds are used to reduce the number of interrupts to the host; vectored interrupts, context switching technique and a Good Data transfer scheme are used to reduce the number of microprocessor cycles needed to fetch a byte of data.

Cirrus Logic

Functional Block Diagram



FOR MORE INFORMATION, CONTACT:
CIRRUS LOGIC, INC., 3100 W. Warren Ave., Fremont, CA 94539 510/623-8300

CYPRESS SEMICONDUCTOR

About Cypress Semiconductor

Cypress Semiconductor Corporation was founded in 1983 to produce the highest-performance integrated circuits using state-of-the-art processes and circuit design. Cypress is a complete semiconductor manufacturer, performing its own process development, circuit design, wafer fabrication, assembly, and test. It has successfully addressed diverse, high-performance niche markets by creating technologically sophisticated products, using innovative packaging, and emphasizing quality.

Its core CMOS and BiCMOS processes lead the industry with 0.8-micron design rules. Cypress ships over 200 products in seven product areas: SRAMs, PROMs, PLDs, logic devices, SPARC™ microprocessors and peripherals, multichip modules, and high-speed BiCMOS PLD and memory devices.

Cypress technologies have been carefully designed, creating high-speed products with excellent reliability and low power.

Cypress is an international company with headquarters in San Jose, California and fabrication facilities in California, Texas, and Minnesota. The company has five subsidiaries, including Cypress Semiconductor (Texas) Inc., Aspen Semiconductor Corporation, Multichip Technology Incorporated, Ross Technology Inc., and Cypress Semiconductor (Minnesota) Inc.

For a copy of the **Cypress Data Book**, call **1-800-858-1810** and ask for **Department CC1**.

SRAMs
- 1K and 4K ECL
- 16K and 64K ECL
- 64K to 256K BiCMOS (TTL I/O)
- 4K to 1M CMOS
- 4K x 18 Cache Tag
- 128K, 256K, 288K Cache RAM

PROMs
- 512 x 8 to 64K x 8
- 512 x 8 to 64K x 8 (Registered)
- 8K x 8 Diagnostic

PLDs
- Industry Standards
  - 20-pin CMOS and ECL
  - CMOS and BiCMOS 22V10
- Application-Tailored
  - 28-pin State Machine
  - 28-pin Address Decoder
  - 28-pin Asynchronous
- Universal Solutions
  - 28-pin to 84-pin MAX PLDs
  - 20-pin 18G8 and 24-pin 20G10

Logic
- FIFOs to 32K x 9
- Bidirectional FIFOs, 2K x 9
- Dual-Port SRAMs to 8K x 8
- 16-bit Microprocessor - Slice
- VMEBus Controllers

RISC
- SPARC® Chip Sets
  - Integer Unit (CPU)
  - Floating Point Unit
  - Cache Controller MMU
  - Embedded Controller
- SPARCore™ Modules

Modules
- SRAMS
  - 256K x 16
  - 64K x 32
  - 256K x 32
  - 512K x 8
- FIFOs
- Cascadeable 8K x 9
- Cascadeable 16K x 9

SPARC is a registered trademark of SPARC International.
SPARCore is a trademark of ROSS Technology Inc.

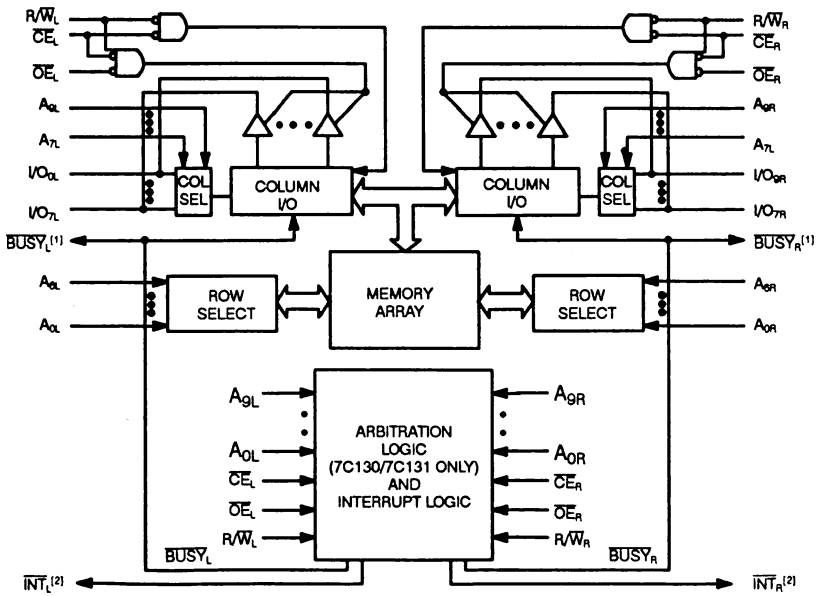
Cypress Semiconductor

CY7C130/CY7C131/CY7C140/CY7C141
1K x 8 Dual-Port Static RAM

Features

- 25-ns access time
- 0.8-micron CMOS for optimum speed/power
- Automatic power-down
- TTL compatible
- Capable of withstanding greater than 2001V electrostatic discharge
- Fully asynchronous operation
- Master CY7C130/CY7C131 easily expands data bus width to 16 or more bits using SLAVE CY7C140/CY7C141
- $\overline{BUSY}$ output flag on CY7C130/CY7C131; $\overline{BUSY}$ input on CY7C140/CY7C141
- $\overline{INT}$ flag for port-to-port communication

Logic Block Diagram



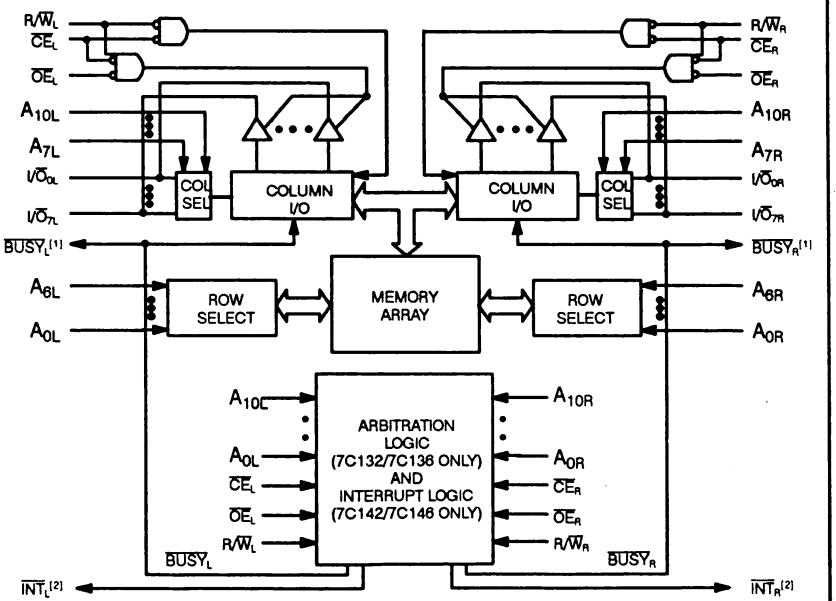
Notes:
1. CY7C130/CY7C131 (Master): $\overline{BUSY}$ is open drain output and requires pull-up resistor. CY7C140/CY7C141 (Slave): $\overline{BUSY}$ is input.
2. Open drain outputs: pull-up resistor required.

CY7C132/CY7C136/CY7C142/CY7C146
2K x 8 Dual-Port Static RAM

Features

- 25-ns access time
- 0.8-micron CMOS for optimum speed/power
- Automatic power-down
- TTL compatible
- Capable of withstanding greater than 2001V electrostatic discharge
- Fully asynchronous operation
- MASTER CY7C132/CY7C136 easily expands data bus width to 16 or more bits using SLAVE CY7C142/CY7C146
- $\overline{BUSY}$ output flag on CY7C132/CY7C136; $\overline{BUSY}$ input on CY7C142/CY7C146
- $\overline{INT}$ flag for port-to-port communication (52-pin LCC/PLCC versions)

Logic Block Diagram



Notes:
1. CY7C132/CY7C136 (Master): $\overline{BUSY}$ is open drain output and requires pull-up resistor. CY7C142/CY7C146 (Slave): $\overline{BUSY}$ is input.
2. Open drain outputs; pull-up resistor required.

CYPRESS SEMICONDUCTOR 3901 North First Street CA 95134
For a Data Book, call: 1-800-858-1810 Dept. CC1

CY7B180/CY7B181
4K x 18 Cache Tag RAM

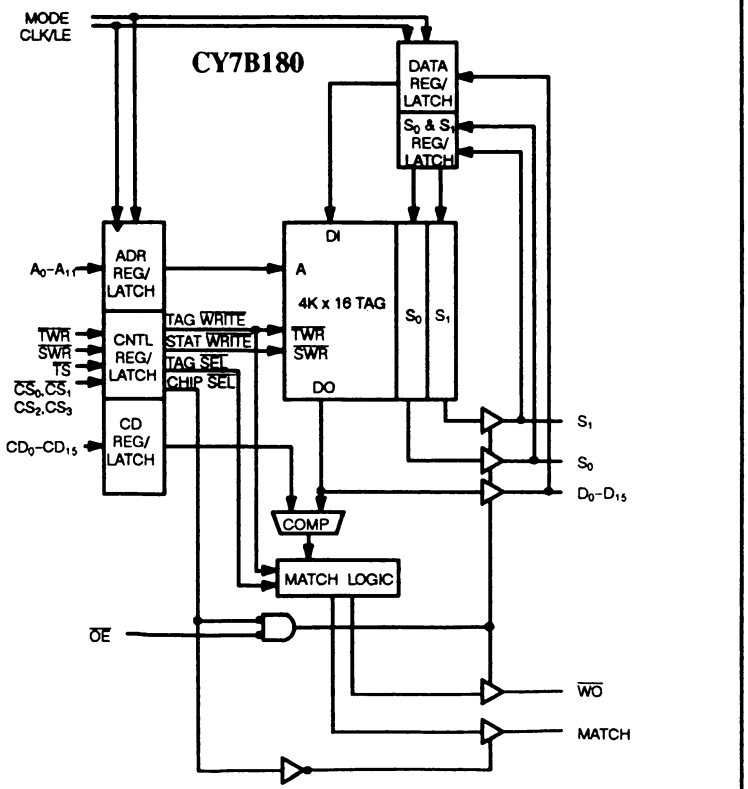
Features

- 4K x 18 tag organization
- Can be used as 4K x 18 SRAM
- BiCMOS for optimum speed/power
- High speed
  - 12-ns match delay
  - 15-ns tag SRAM access
- Selectable clock and latch modes
- Input address and data latches

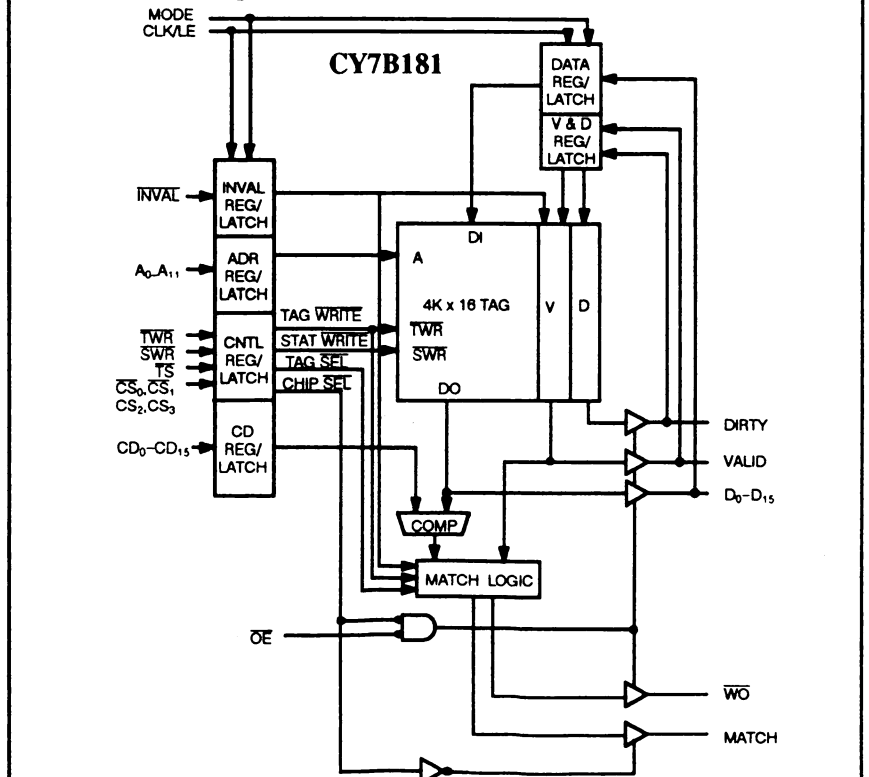
Features (continued)

- Supports multiprocessing (7B180) with two cache status bits per entry
- Supports dirty and valid bits (7B181)
- Dirty-bit set on write hit (7B181)
- Two-cycle tag invalidation (7B181)
- Match qualified by valid bit (7B181)
- Write output to cache RAM asserted during write hit
- Cascadeable
  - up to four cache tags

Logic Block Diagram



Logic Block Diagram



When contacting suppliers, say you saw it in IC MASTER

CYPRESS SEMICONDUCTOR 3901 North First Street CA 95134

For a Data Book, call: 1-800-858-1810 Dept. CC1

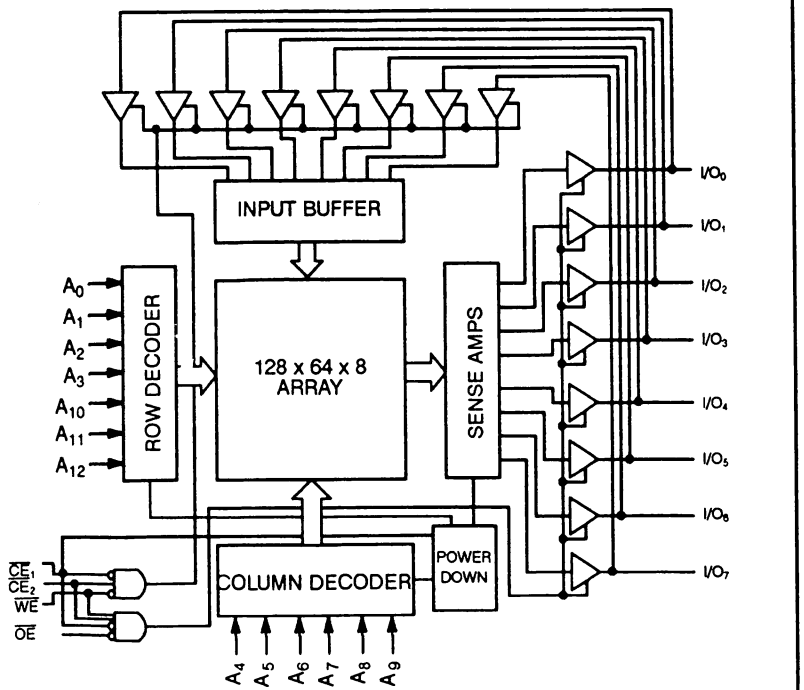
When contacting suppliers, say you saw it in IC MASTER

CY7B185
8K x 8 Static RAM

Features

- Ultra high speed
  - t_{AA} = 9 ns
- BiCMOS for optimum speed/power
- Low active power
  - 750 mW
- Low standby power
  - 250 mW
- TTL-compatible inputs and outputs
- Capable of withstanding greater than 2001V electrostatic discharge

Logic Block Diagram

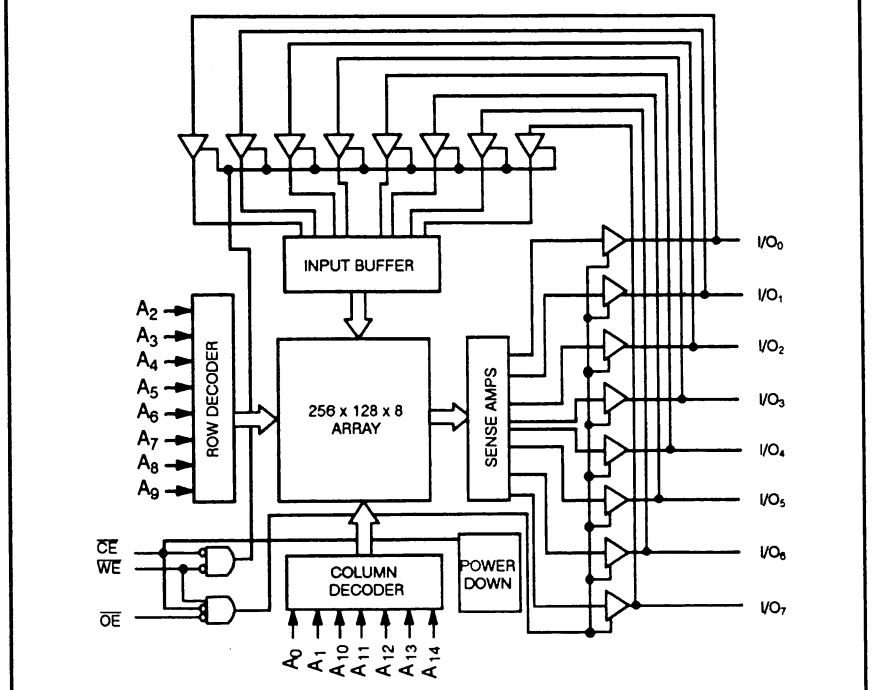


CY7B199
32K x 8 Static R/W RAM

Features

- High speed
  - t_{AA} = 12 ns
- BiCMOS for optimum speed/power
- Low active power
  - 853 mW
- Low standby power
  - 275 mW
- Automatic power-down when deselected
- TTL-compatible inputs and outputs

Logic Block Diagram



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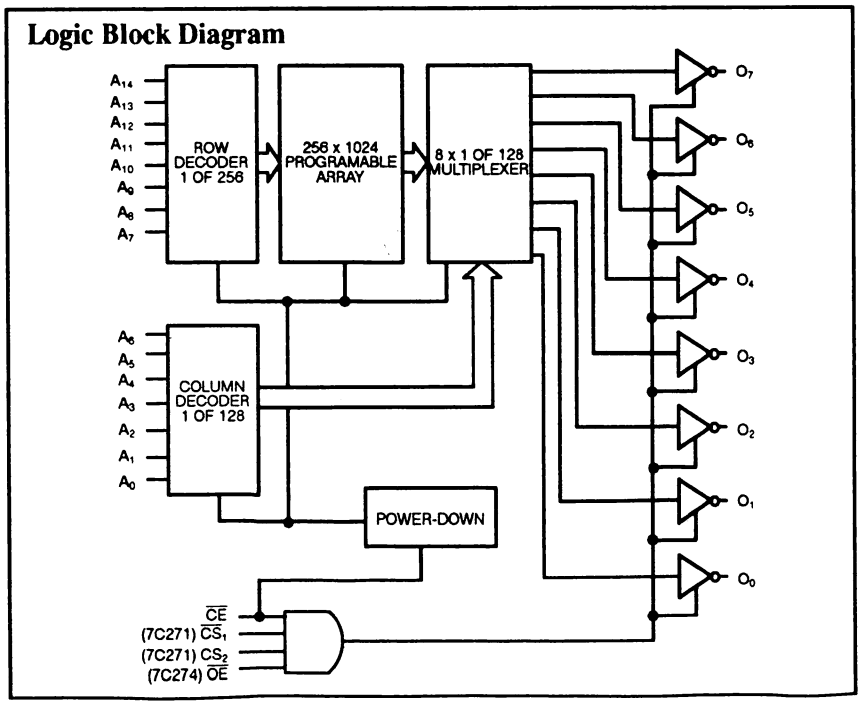
CY7C271/CY7C274
32K x 8 PROM, Power Switched and Reprog.

Features

- CMOS for optimum speed/power
- Windowed for reprogrammability
- High speed
  - 30 ns (commercial)
  - 35 ns (military)
- Low power
  - 660 mW (commercial)
  - 715 mW (military)
- Super low standby power
  - Less than 165 mW when deselected
- EPROM technology 100%programmable
- Slim 300-mil package (7C271)
- Direct replacement for bipolar PROMs

Logic Block Diagram

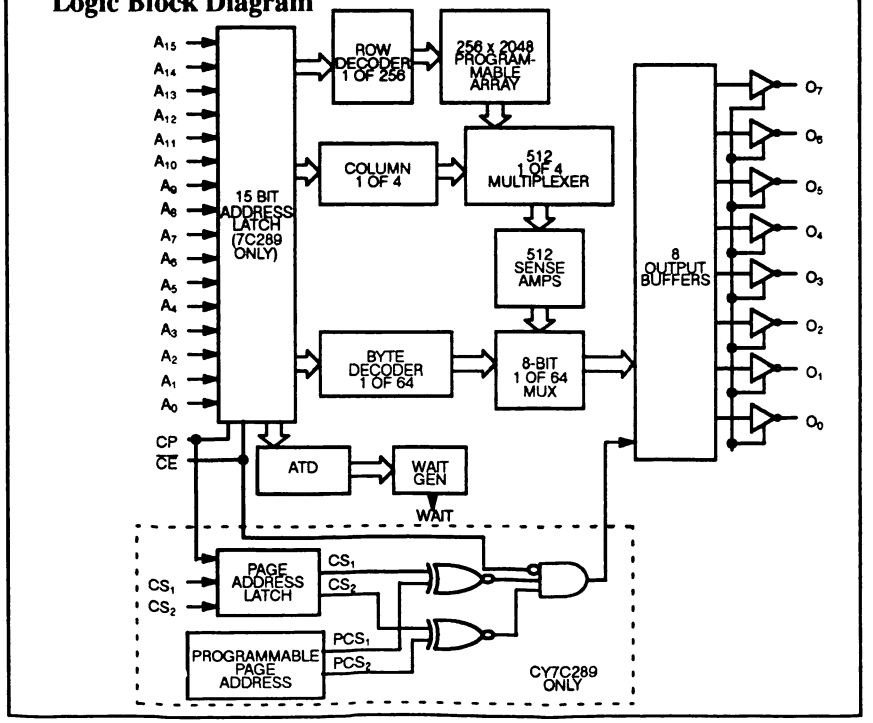


CY7C285/CY7C289
65K x 8 Reprog. Fast Column Access PROM

Features

- CMOS for optimum speed/power
- Windowed for reprogrammability
- Unique fast column access
  - t_{AA} = 15 ns (commercial)
  - t_{AA} = 25 ns (military)
- WAIT signal
- User configurable chip select decoding (7C289)
- EPROM technology, 100% programmable
- 5V ±10% V_{CC}, commercial and military
- TTL-compatible I/O
- Slim 300-mil package
- Capable of withstanding >2001V static discharge

Logic Block Diagram



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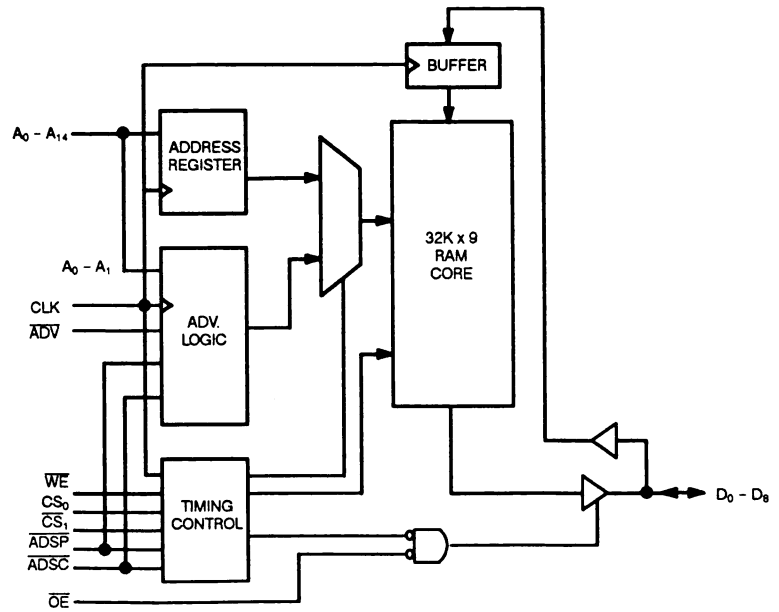
CY7B173/CY7B174
32K x 9 Synchronous Cache R/W RAM

Features

- 32K by 9 common I/O
- BiCMOS for optimum speed/power
- 14-ns access delay (clock to output)
- Two-bit wraparound counter supporting the 486 burst sequence (7B173)
- Two-bit wraparound counter supporting the linear burst sequence (7B174)
- Separate address strobes from processor and from cache controller
- Synchronous self-timed write
- Direct interface with the processor and external cache controller
- Two complementary synchronous chip selects
- Asynchronous output enable
- 44-pin PLCC and LCC

Logic Block Diagram

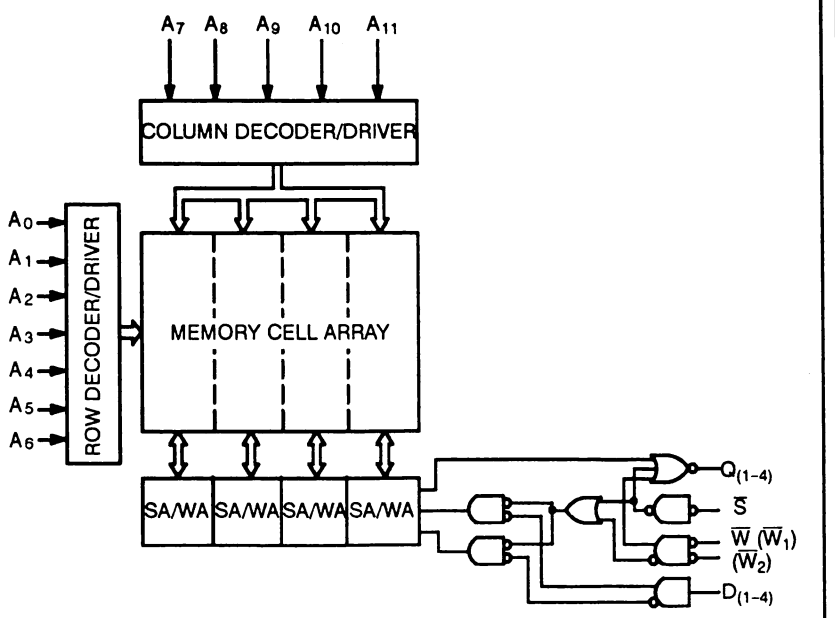


CY101E484/CY10E484/CY100E484
4K x 4 ECL Static RAM

Features

- 4096 x 4-bit organization
- Ultra high speed/standard power
  - t_{AA} = 5 ns
  - I_{EE} = 320 mA
- Low-power version
  - t_{AA} = 7, 8, 10 ns
  - I_{EE} = 200 mA
- Both 10KH/10K- and 100K-compatible I/O versions
- On-chip voltage compensation for improved noise margin
- Capable of withstanding >2001V ESD
- Open emitter output for ease of memory expansion
- Industry-standard pinout

Logic Block Diagram



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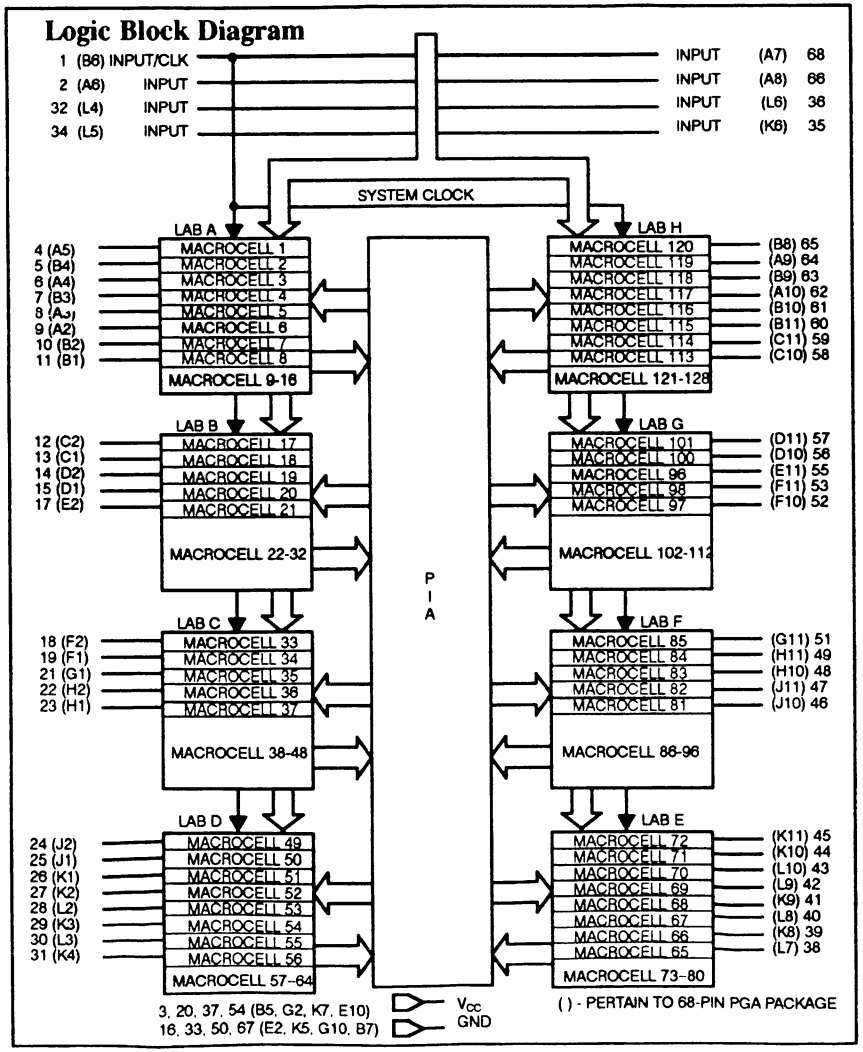
CY7C342 – 128-Macrocell MAX® EPLDs

Features

- 128 macrocells in 8 LABs
- Pipelined data rates up to 62.5 MHz
- 8 dedicated inputs, 52 bidirectional I/O pins
- Available in 68-pin HLCC, PLCC, and PGA
- t_{PD} as fast as 25 ns
- Programmable interconnect array
- Counter frequencies up to 50 MHz

MAX is a registered trademark of Altera Corp.

Logic Block Diagram

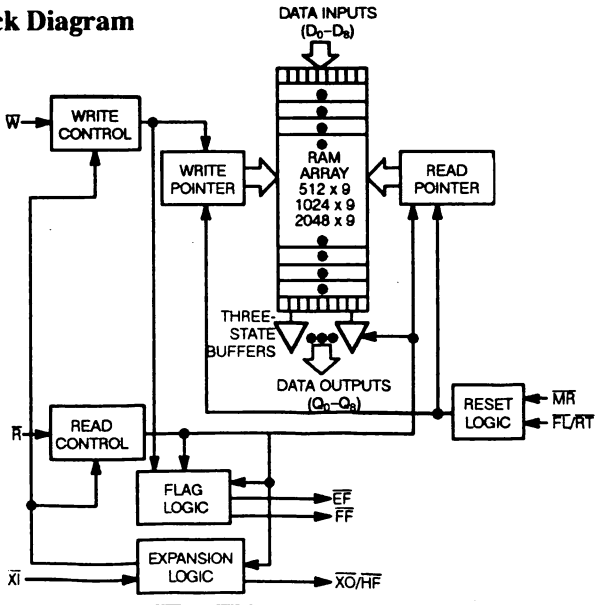


CY7C420/421/424/425/428/429
Cascadeable 512 x 9, 1K x 9, 2K x 9 FIFO

Features

- 512 x 9, 1,024 x 9, 2,048 x 9 FIFO buffer memory
- Dual-port RAM cell
- Asynchronous read/write
- High-speed 33.3-MHz read/write independent of depth/width
- Low operating power
  - I_{CC} (max.) = 142 mA (commercial), 147 mA (military)
- Half Full flag in standalone
- Empty and Full flags
- Retransmit in standalone
- Expandable in width and depth
- Parallel cascade minimizes bubble-through
- 5V ± 10% supply
- 300-mil DIP and SOJ packaging
- TTL compatible
- Three-state outputs
- Pin compatible and functional equivalent to IDT7201, IDT7202, and IDT7203

Logic Block Diagram



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IC MASTER 1992 When contacting suppliers, say you saw it in IC MASTER 3437

PAL22V10C/PAL22VP10C
Universal PAL® Device

Features

- Ultra high speed supports today's and tomorrow's fastest microprocessors
  - t_{PD} = 7.5 ns, t_S = 3 ns, f_{MAX} = 111 MHz
- Reduced ground bounce and undershoot
- Guaranteed simultaneous switching noise level
- PLCC and LCC packages with additional V_{CC} and V_{SS} pins for lowest ground bounce
- Up to 22 inputs and 10 outputs for more logic power
- Variable product terms
  - 8 to 16 per output
- 10 user-programmable output macrocells
  - Output polarity control
  - Registered or combinatorial operation
  - 2 new feedback paths (PAL22VP10C)
- Synchronous PRESET, asynchronous RESET, and PRELOAD capability for flexible design and testability
- High reliability
  - Proven Ti-W fuse technology
  - AC and DC tested at the factory
- Security Fuse
- Enhanced macrocell with pin feedback

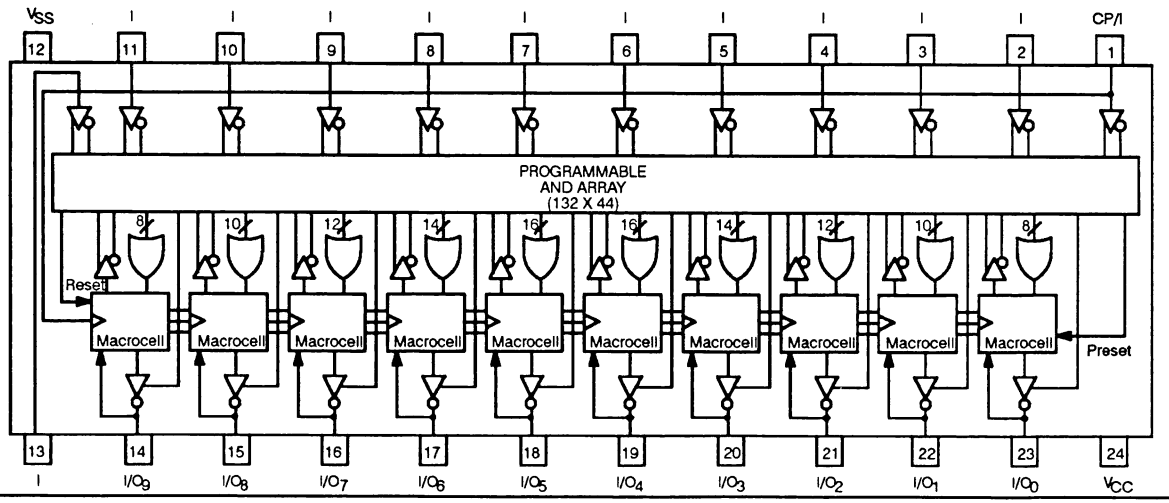
PALC22V10B/PALC22V10
Reprogrammable CMOS PAL Device

Features

- Advanced second-generation PAL architecture
- Low power
  - 55 mA max. "L" for 25-ns version
  - 90 mA max. standard
  - 120 mA max. military
- CMOS EPROM technology for reprogrammability
- Variable product terms
  - 2 x (8 through 16) product terms
- User-programmable macrocell
  - Output polarity control
  - Individually selectable for registered or combinatorial operation
  - "15" commercial, industrial, and military: t_{CO} = 10 ns, t_{PD} = 15 ns, t_S = 10 ns (12 ns for military), 50 MHz
  - 20-, 25-, and 35-ns versions also available
- Up to 22 input terms and 10 outputs
- High reliability
  - Proven EPROM technology
  - 100% programming and functional testing
- Windowed DIP, windowed LCC, DIP, LCC, and PLCC available

PAL is a registered trademark of Advanced Mico Devices.

Logic Block Diagram



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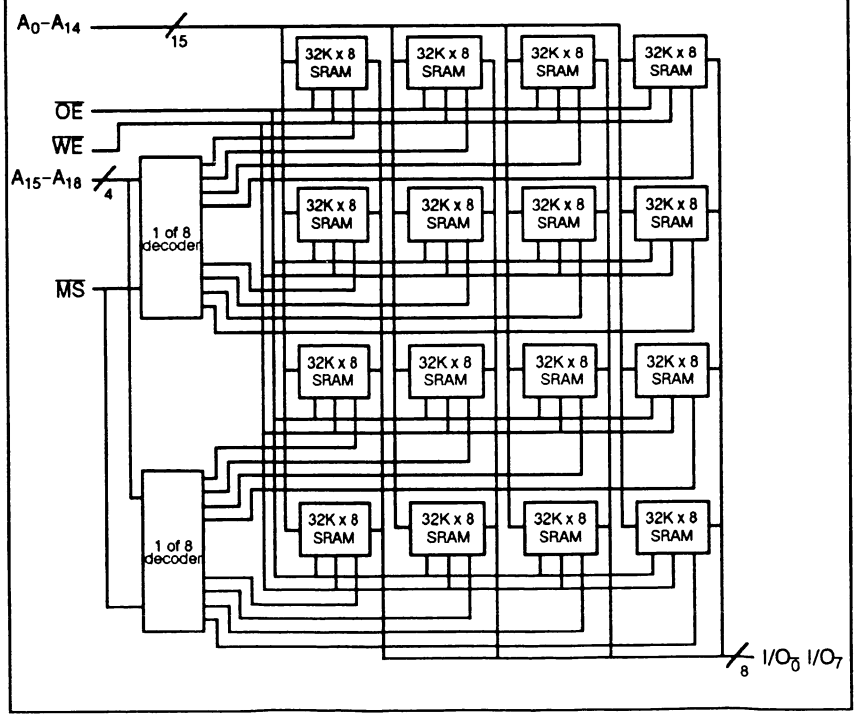
CYM1460

Features

- High-density 4-megabit SRAM module
- High-speed CMOS SRAMs
  - Access time of 35 ns
- Low active power
  - 3.4W (max.)
- Double-sided SMD technology
- TTL-compatible inputs and outputs
- Low profile version (PF)
  - Max. height of .345 in.
- Small footprint SIP version (PS)
  - PCB layout area of 1.2 sq. in.

Logic Block Diagram

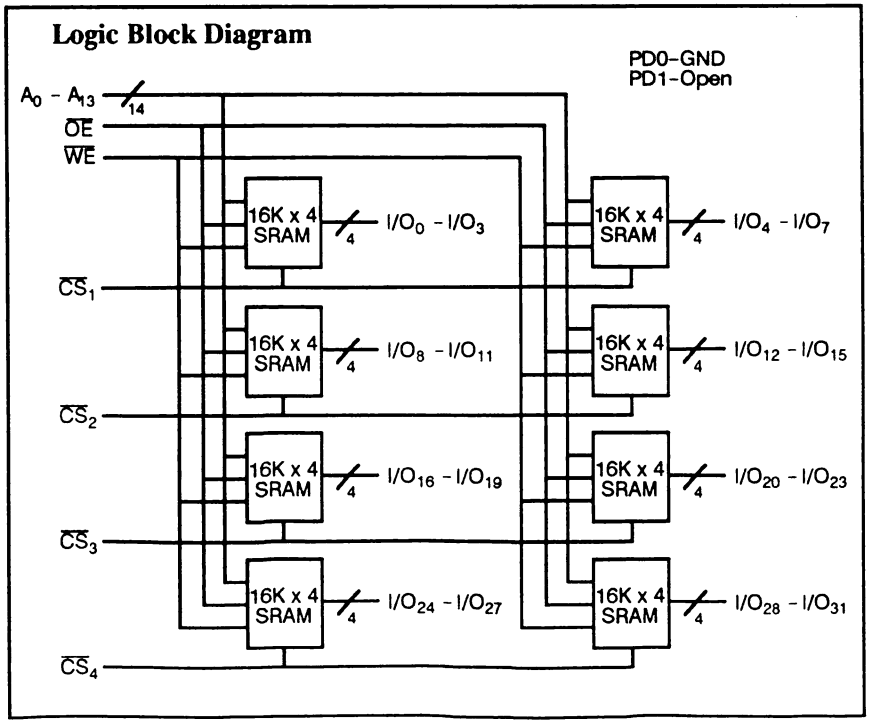


CYM1821

Features

- High-density 512-kbit SRAM module
- High-speed CMOS SRAMs
  - Access time of 12 ns
- Low active power – 4W (max.)
- SMD technology
- TTL-compatible inputs and outputs
- Low profile
  - Max. height of .50 in.
- Small PCB footprint
  - 1.0 sq. in.
- JEDEC-compatible pinout
- 2V data retention (L version)
- SIMM version socket-compatible with CYM1831 and CYM1841

Logic Block Diagram



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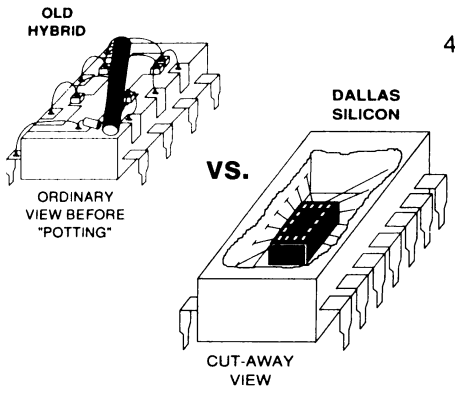

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Dallas, Texas 75244-3292
Telephone 214-450-0400
FAX: 214-450-0470

DALLAS SEMICONDUCTOR

Five Years Experience Making Silicon Delay Lines

- All Silicon time delays
- Leading and trailing edge accuracy
- Auto insertable, low profile
- Standard 14-Pin DIP, 8-Pin DIP, Gullwing
- 16-Pin SOIC
- Extended temperature range available
- Low Power CMOS
- TTL/CMOS compatible
- Vapor phase, IR and wave solderability
- Custom delays and quick turn prototypes available

LASER-WRITTEN PRODUCT FAMILIES

DS1000 5-Tap Silicon Delay Line	14-Pin DIP	DS1000-xxx	xxx = 025 to 500ns
	14-Pin DIP Sheared NC	DS1000K-xxx	xxx = 025 to 500ns
	8-Pin DIP	DS1000M-xxx	xxx = 025 to 500ns
	14-Pin GULLWING	DS1000G-xxx	xxx = 025 to 500ns
	8-Pin GULLWING	DS1000H-xxx	xxx = 025 to 500ns
	16-Pin SOIC	DS1000S-xxx	xxx = 025 to 500ns
	8-Pin SOIC (preliminary)	DS1000Z-xxx	xxx = 025 to 200ns
DS1005 5-Tap Silicon Delay Line Voltage Compensated	14-Pin DIP	DS1005-xxx	xxx = 060 to 250ns
	14-Pin DIP Sheared NC	DS1005K-xxx	xxx = 060 to 250ns
	8-Pin DIP	DS1005M-xxx	xxx = 060 to 250ns
	14-Pin GULLWING	DS1005G-xxx	xxx = 060 to 250ns
	8-Pin GULLWING	DS1005H-xxx	xxx = 060 to 250ns
	16-Pin SOIC	DS1005S-xxx	xxx = 060 to 250ns
DS1003 4-Tap Silicon Risc Delay Line	14-Pin DIP	DS1003-xxx	xxx = Risc -16 to -50
	14-Pin GULLWING	DS1003G-xxx	xxx = Risc -16 to -50
	8-Pin DIP	DS1003M-xxx	xxx = Risc -16 to -50
	8-Pin GULLWING	DS1003H-xxx	xxx = Risc -16 to -50
DS1007 7-in-1 Silicon Delay Line	16-Pin DIP	DS1007-xxx	xxx = 003 to 60ns
	16-Pin GULLWING	DS1007G-xxx	xxx = 003 to 60ns
	16-Pin SOIC	DS1007S-xxx	xxx = 003 to 60ns
DS1010 10-Tap Silicon Delay Line	14-Pin DIP	DS1010-xxx	xxx = 050 to 500ns
	14-Pin GULLWING	DS1010G-xxx	xxx = 050 to 500ns
	16-Pin SOIC	DS1010S-xxx	xxx = 050 to 500ns
DS1012 (preliminary) 2-in-1 Subminiature Silicon Delay Line With Logic	8-Pin DIP	DS1012M-xxx	xxx = 001 to 999
	8-Pin GULLWING	DS1012H-xxx	xxx = 001 to 999
	8-Pin SOIC	DS1012S-xxx	xxx = 001 to 999
DS1013 3-in-1 Silicon Delay Line Voltage Compensated	14-Pin DIP	DS1013-xxx	xxx = 015 to150ns
	8-Pin DIP	DS1013M-xxx	xxx = 015 to150ns
	14-Pin GULLWING	DS1013G-xxx	xxx = 015 to 150ns
	8-Pin GULLWING	DS1013H-xxx	xxx = 015 to 150ns
	16-Pin GULLWING	DS1013S-xxx	xxx = 015 to 150ns
DS1020 (preliminary) 8-Bit Programmable Silicon Delay Line	16-Pin DIP	DS1020-25	0.25ns Steps
	16-Pin DIP	DS1020-50	0.50ns Steps
	16-Pin DIP	DS1020-100	1.00ns Steps
	16-Pin DIP	DS1020-200	2.00ns Steps
	16-Pin SOIC	DS1020S-25	0.25ns Steps
	16-Pin SOIC	DS1020S-50	0.50ns Steps
	16-Pin SOIC	DS1020S-100	1.00ns Steps
	16-Pin SOIC	DS1020S-200	2.00ns Steps
DS1040 (preliminary) Programmable One Shot Pulse Generator	8-Pin DIP	DS1040M-xxx	xxx = 50ns to 500ns
	8-Pin GULLWING	DS1040H-xxx	xxx = 50ns to 500ns
	8-Pin SOIC	DS1040Z-xxx	xxx = 50ns to 500ns
DS1045 (preliminary) 4-Bit Dual Programmable Silicon Delay Line	16-Pin DIP	DS1045-xxx	xxx = 6ns to 81ns
	16-Pin SOIC	DS1045S-xxx	xxx = 6ns to 81ns

Specification temp. 0° to 70°C ■ Operating temp. -40°C to +85°C ■ Storage temp. -55°C to +125°C ■ Soldering temp. 260°C for 10 seconds

Dallas Semiconductor

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SAMPLING A/D CONVERTERS

	Model	Resolution (Bits)	Throughput (MHz)	Linearity Error (Max)	Power Watts (Max)	Case
	ADC-HS12B	12	0.066	±3/4 LSB	1.8	32-Pin DIP
	ADS-111	12	0.500	±3/4 LSB	1.8	24-Pin DIP
	ADS-112	12	1.0	±3/4 LSB	1.7	24-Pin DIP
	ADS-193	12	1.0	±3/4 LSB	1.7	40-Pin DIP
	ADS-132	12	2.0	±3/4 LSB	3.2	32-Pin DIP
New	**ADS-117**	12	2.0	±3/4 LSB	1.8	24-Pin DIP
New	**ADS-118**	12	5.0	±1 LSB	2.5	24-Pin DIP
	ADS-131	12	5.0	±1 LSB	4.0	40-Pin DIP
	ADS-130	12	10.0	±1 LSB	4.2	40-Pin DIP
Advance	**ADS-120**	12	20.0	±1 LSB	4.2	40-Pin DIP
	ADS-924	14	0.300	±1 LSB	1.8	24-Pin DIP
	ADS-928	14	0.500	±3/4 LSB	3.4	32-Pin DIP
New	**ADS-941**	14	1.0	±3/4 LSB	3.3	32-Pin DIP
New	**ADS-942**	14	2.0	±1 LSB	3.4	32-Pin DIP
Advance	**ADS-944**	14	5.0	±1 LSB	3.4	32-Pin DIP
Advance	**ADS-945**	14	10.0	±1 LSB	4.2	40 Pin DIP
Advance	**ADS-926**	14	0.500	±3/4 LSB	1.6	28-Pin DIP
Advance	**ADS-927**	14	1.0	±3/4 LSB	1.7	28-Pin DIP
New	**ADS-930**	16	0.500	±1 1/2 LSB	3.4	40-Pin DIP

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A/D CONVERTERS

	Model	Resolution (Bits)	Conversion Time (µsec)	Linearity Error	Power (Watts)	Case
	ADC-207	7	0.050	±1/2 LSB	0.25	18-Pin DIP
	ADC-228	8	0.040	±1/2 LSB	1.25	24-Pin DIP
	ADC-208	8	0.050	±3/4 LSB	0.60	24-Pin DIP
	ADC-304	8	0.050	±1/2 LSB	0.39	28-Pin DIP
	ADC-530	12	0.350	±3/4 LSB	2.10	32-Pin DIP
	ADC-500	12	0.500	±1 LSB	1.70	32-Pin DIP
	ADC-505	12	0.550	±1 LSB	1.70	32-Pin DIP
	ADC-508	12	0.700	±1 LSB	1.70	32-Pin DIP
	ADC-520	12	0.800	±1/2 LSB	1.60	32-Pin DIP
	ADC-521	12	0.800	±1/2 LSB	1.60	32-Pin DIP
	ADC-511	12	1.0	±3/4 LSB	1.25	24-Pin DIP
	ADC-HZ12B	12	8	±1/2 LSB	1.5	32-Pin DIP
	ADC-HX12B	12	20	±1/2 LSB	1.5	32-Pin DIP
	ADC-HC12B	12	300	±1/2 LSB	0.17	32-Pin DIP
	ADC-908	14	1.0	±1/2 LSB	2.70	32-Pin DIP
	ADC-914	14	2.4	±1 LSB	1.20	24-Pin DIP

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D/A CONVERTERS

Model	Resolution (Bits)	Settling Time	Linearity Error	Power (Watts)	Case
DAC-HF8	8	25 ns	±1/2 LSB	0.750	24-Pin DIP
DAC-HF10	10	25 ns	±1/2 LSB	0.900	24-Pin DIP
DAC-HF12	12	50 ns	±1/2 LSB	0.900	24-Pin DIP
DAC-HK12	12	3 µs	±1/2LSB	0.700	24-Pin DIP
DAC-HZ12	12	3 µs	±1/2 LSB	0.390	24-Pin DIP
DAC-HP16	16	15 µs	±0.003% FSR	0.600	24-Pin DIP

HYBRID DATA ACQUISITION SYSTEMS

	Model	Resolution (Bits)	Throughput (KHz)	Linearity Error (Max)	Power (Watts Max)	Channels	Case
	HDAS-16	12	50	±3/4 LSB	1.75	16 SE	62-Pin
	HDAS-8	12	50	±3/4 LSB	1.75	8 DE	62-Pin
	HDAS-75	12	75	±3/4 LSB	0.7	8 SE	40-Pin DIP
	HDAS-76	12	75	±3/4 LSB	0.7	4 DE	40-Pin DIP
	HDAS-534	12	250	±3/4 LSB	3.0	4 DE	40-Pin DIP
	HDAS-538	12	250	±3/4 LSB	3.0	8 SE	40-PIN DIP
	HDAS-524	12	400	±3/4 LSB	3.0	4 DE	40-Pin DIP
	HDAS-528	12	400	±3/4 LSB	3.0	8 SE	40-Pin DIP

SAMPLE HOLD AMPLIFIERS

	Model	Linearity (%)	Acquisition Time	Aperture Delay	Aperture Jitter	Bandwidth (MHz)	Hold Mode Droop	Case
	SHM-HU	0.1	25 ns	6 ns	10 ps	50	50 µv/µs	24-Pin DIP
	SHM-7	0.1	40 ns	3 ns	10 ps	40	100 µV/µs	24-Pin DIP
	SHM 40	0.1	40 ns	3 ns	10 ps	40	100 µV/µs	24-Pin DIP
	SHM-6	0.02	2 µs	20 ns	2 ns	5	10 µv/µs	32-Pin DIP
New	**SHM-43**	0.01	35 ns	5 ns	1 ps	150	5 µV/µs	24-Pin DIP
New	**SHM-49**	0.01	140 ns	6 ns	15 ps	16	1 µV/µs	8-Pin DIP
	SHM-45	0.01	200 ns	6 ns	±50 ps	16	0.5µV/µs	24-Pin DIP
	SHM-4860	0.01	200 ns	6 ns	±50 ps	16	0.5µV/µs	24-Pin DIP
	SHM-30	0.01	500 ns	-25 ns	0.1 ns	4.5	0.01 µV/µs	14-Pin DIP
	SHM-20	0.01	1µs	30 ns	1 ns	2	0.8µV/µs	14-Pin DIP
	SHM-91	0.003	2 µs	15 ns	300 ps	2	5 µV/µs	24-Pin DIP
New	**SHM-945**	0.0004	500 ns	5ns	10 ps	12	0.5 µV/µs	24-Pin DIP
New	**MSH-840***	0.01	750 ns	6 ns	±1 ns	1	1 µV/µs	32-Pin DIP

*QUAD Simultaneous Sample-Hold with 4-Channel Multiplexer

Datel

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MULTIPLEXERS

	Model	Channels	Settling Time 20V to 0.01%	Access Time	Input Range	Power (Watts)	Case
	MXD-409	4 D	3 µs	500 ns	±15V	0.105	16-Pin DIP
	MX-808	8 SE	3 µs	500 ns	±15V	0.105	16-Pin DIP
	MXD-807	8 D	3 µs	500 ns	±15V	0.105	28-Pin DIP
	MX-1606	16 SE	3 µs	500 ns	±15V	0.105	28-Pin DIP
	MVD-409	4 D	2.8 µs	350 ns	±15V	0.055	16-Pin DIP
	MV-808	8 SE	2.8 µs	350 ns	±15V	0.055	16-Pin DIP
	MVD-807	8 D	2.4 µs	300 ns	±15V	0.105	28-Pin DIP
	MV-1606	16 SE	2.4 µs	300 ns	±15V	0.105	28-Pin DIP
	MX-818C	8 SE/4D	800 ns	125 ns	±15V	0.540	18-Pin DIP
	MX-1616C	16 SE/8 D	800 ns	150 ns	±15V	0.900	28-Pin DIP
New	**MX-826**	8 SE	200 ns	70 ns	±10.5V	0.395	24-Pin DIP
New	**MX-850**	4 SE	50 ns	20 ns	±10V	0.250	14-Pin DIP

OPERATIONAL AMPLIFIERS

Datel

Model	DC Open Loop Gain (V/V)	Settling Time (µsec)	Slew Rate (V/µsec)	Gain Bandwidth (MHz)	Case
AM-500	10^6	200 ns/0.01%	1000	100	14-Pin DIP
AM-1435	10^5	70 ns/0.01%	300	1000	14-Pin DIP

INSTRUMENTATION AMPLIFIERS

Model	Gain Range	Settling Time	Case
AM-551	1 to 1000	2 µs/0.01%	16-Pin DIP

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TUNABLE ACTIVE FILTERS

Model	Poles	Low Pass	High Pass	Band Pass	Band Reject	Rolloff (dB/Oct)	Frequency Cutoff Range (FC)	Filter Type	Gain	Case
*FLT-DL41**	4	♦				30	100 to 400KHz	CA	+1	32 DIP
*FLT-DL42**	4	♦				30	250 to 1000 KHz	CA	+1	32 DIP
*FLT-DL51**	5	♦				50	120 to 470 KHz	CA	+1	32 DIP
*FLT-DL52**	5	♦				50	300 to 1200KHz	CA	+1	32 DIP
*FLT-DL41/DL51§**	7	♦				50	100 to 400KHz	CA	+1	2-32 DIP
*FLT-DL42/DL52§**	7	♦				50	0.25 to 1.0MHz	CA	+1	2-32 DIP
FLT-C1	7	♦				52	78 Hz-20 KHz	CH	1, 2, 4, 8	32 DIP
FLJ-DC	2	♦	♦	♦	♦	12	1 Hz-159 KHz	BU,CH,BE	1 ~ 10	40 QDIP
FLJ-D1	2	♦	♦	♦	♦	12	1 Hz-1.599 KHz	BU	1 ~ 10	40 QDIP
FLJ-D2	2	♦	♦	♦	♦	12	100 Hz-159.9 KHz	BU	1 ~ 10	40 QDIP
FLJ-D5LA1	5	♦				60	10 Hz-2 KHz	CA	0 ±0.3 dB max	40 QDIP
FLJ-D5LA2	5	♦				60	100 Hz-20 KHz	CA	0 ±0.3 dB max	40 QDIP
FLJ-D6LA1	6	♦				80	10 Hz-2 KHz	CA	0 ±0.3 dB max	40 QDIP
FLJ-D6LA2	6	♦				80	100 Hz-20 KHz	CA	0 ±0.3 dB max	40 QDIP
FLJ-VB	2			♦		12	200Hz-20KHz	BU	±1dB	40 QDIP
FLJ-VH	4		♦			24	20Hz-20KHz	BU	±0.5dB	40 QDIP
FLJ-VL	4	♦				24	100Hz-100KHz	BU	±0.5dB	40 QDIP
FLJ-R3BA1	3			♦		—	10Hz-2KHz	CA	0 ±1dB max	40 QDIP
FLJ-R3BA2	3			♦		—	100Hz-20KHz	CA	0 ±1dB max	40 QDIP
FLJ-R8LA1	8	♦				135	10Hz-2KHz	CA	0 ±0.1dB max	40 QDIP
FLJ-R8LA2	8	♦				135	100Hz-20KHz	CA	0 ±0.1dB max	40 QDIP
FLJ-R8LB1	8	♦				100	10Hz-2KHz	CA	0 ±0.1dB max	40 QDIP
FLJ-R8LB2	8	♦				100	100Hz-20KHz	CA	0 ±0.1dB max	40 QDIP
FLJ-UR1BA1	1			♦		—	40Hz-1.6KHz	BU	0 ±1dB	20 SIP
FLJ-UR2BA1	2			♦		- -	40Hz-1.6KHz	BU	0 ±1dB	20 SIP
FLJ-UR2EA1	2				♦	—	40Hz-1.6KHz	BU	0 ±0.3dB	20 SIP
FLJ-UR2LH1	2	♦	♦			12	40Hz-1.6KHz	BU	0 ±0.3dB	20 SIP
FLJ-UR4HA1	4		♦			24	40Hz-1.6KHz	BU	0 ±1dB	20 SIP
FLJ-UR4HB1	4		♦			42	40Hz-1.6KHz	CH	0 ±1dB	20 SIP
FLJ-UR4LA1	4	♦				24	40Hz-1.6KHz	BU	0 ±0.3dB	20 SIP
FLJ-UR4LB1	4	♦				42	40Hz-1.6KHz	CH	0 ±0.3dB	20 SIP
FLJ-UR1BA2	1			♦		—	400Hz-10KHz	BU	0 ±1dB	20 SIP
FLJ-UR2BA2	2			♦		- -	400Hz-10KHz	BU	0 ±1dB	20 SIP
FLJ-UR2EA2	2				♦	—	400Hz-10KHz	BU	0 ±0.3dB	20 SIP
FLJ-UR2LH2	2	♦	♦			12	400Hz-20KHz	BU	0 ±0.3dB	20 SIP
FLJ-UR4HA2	4		♦			24	400Hz-5KHz	BU	0 ±1dB	20 SIP
FLJ-UR4HB2	4		♦			42	400Hz-5KHz	CH	0 ±1dB	20 SIP
FLJ-UR4LA2	4	♦				24	400Hz-20KHz	BU	0 ±0.3dB	20 SIP
FLJ-UR4LB2	4	♦				42	400Hz-20KHz	CH	0 ±0.3dB	20 SIP
FLT-U2	2	♦	♦	♦		12	0.001Hz-200KHz	BU,CH,BE,CA	0.1-1000	16 DIP

BU = Butterworth BE = Bessel
CH = Chebyshev CA = Cauer/Elliptical

All Filters operate over the commercial temperature range -20°C to +70°C
Model FLT-U2 also operates at -55°C to +125°C

§ Cascaded Pair * Preliminary

For complete details on DATEL's versatile, high performance Signal Conditioning Filters send for the Components Handbook, Volume 1

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VMEBUS A/D - D/A BOARDS

Model	A/D Channels	A/D Resolution	A/D Speed	Prog. Gain Amplifier	In/Out Ranges	D/A Channels	D/A Resolution	Notes
DVME-601A	16 S/ 8 D Expandable to 256	12 Bits	20 µs	x1 to x1K	5, 10V down to 50 mV		None	SA:24, SD:16, 68010 CPU 256K memory RS-232, 5 TTL I/O Counter/Timers "No prgmg" Command Exec., Vectored interrupt
DVME-601B		12 Bits	4 µs					
DVME-601C		16 Bits	35 µs					
DVME-601D		16 Bits	400 ms					
DVME-601E		12 Bits	2 µs					
DVME-611/612A	32 S / 16 D Expandable to 256	12 Bits	20 µs	x1 to x128 Software Pgmble	5V, 10V down to 50 mV	2 (612)	12 Bits	Short I/O SA:16, SD:16 Vectored interrupt
DVME-611/612B		12 Bits	4 µs					
DVME-611/612C		16 Bits	35 µs					
DVME-611/612D		16 Bits	400 ms					
DVME-611/612E		12 Bits	2 µs					
DVME-611/612F		14 Bits	4 µs					
DVME-613	16 S/8 D Isolated 500V	12-14-16 Bits	40 µs	x1 to x100	5V, 10V down to 50 mV	None	---	8 In/8 Out TTL, SA:24, SD:16 Start timer, interrupt
DVME-624	None	---	---	---	2.5 to 10V 4 to 20 mA	4 Isolated	12 Bits	SA:16, SD:16 350V Isolation
DVME-626	None	---	---	---	5V, 10V	6	16 Bits	SA:16, SD:16
DVME-628	None	---	---	---	2.5 to 10V 4 to 20 mA	8	12 Bits	SA:16, SD:16
DVME-641	32 S/16 D	Slave MUX board	6 µs Settling	---	5V, 10V 4 to 20 mA	---	---	Slave input expander to 601, 611, 612
DVME-643	8D Isolated TC's	Slave MUX board	2.5 ms Settling	x50, x100	5V Down to 50 mV	---	---	Slave input expander to 601, 611, 612
DVME-645	16 S/8D	Slave MUX board	6 µs Settling	---	5V, 10V	---	---	Simultaneous Sample/Hold Expander to 601,611,612
DVME-614A	4 Simul. S/H	12 Bits	1.5 MHz	x1 or x10	1V, 5V, 10V	1	12 Bits	4K-sample FIFO memory Analog trigger Parallel data port Sample counter/timer Simultaneous sampling Vectored interrupt
DVME-614B	4 S	14 Bits	500 KHz	---	5V, 10V			
DVME-614C	4 S	12 Bits	1 MHz		5V, 10V			
DVME-614D	1 S	12 Bits	4 MHz		5V, 10V			
DVME-614E	16 S/8 D	12 Bits	500 KHz	x1 to x100	1, 5, 10V, 100mV			
DVME-630A	4 Simul. S/H	12 Bits	1.5 MHz	x1 or x10	1V, 5V, 10V	None	---	Local 32 MHz 320C30 DSP, 512 K Memory, Fast "no prgmg" command Executive, Interrupt DSP library
DVME-630B	4 S	14 Bits	500 KHz	---	5V, 10V			
DVME-630C	4 S	12 Bits	1 MHz		5V, 10V			
DVME-630D	1 S	12 Bits	4 MHz		5V, 10V			
DVME-630E	16 S/8 D	12 Bits	500 KHz	x1 to x100	1, 5, 10V, 100mV			
DVME-622	None	---	---	---	5V, 10V	16 Simul. Update	12 Bits	3 µs settling per channel

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MULTIBUS I

Model	A/D Channels	A/D Resolution	A/D Speed	PGA	In/Out Ranges	D/A Channels	D/A Resolution	Notes
ST-702	8 D Isolated 1 KV	13 Bits	33 ms	x50, x100	5V Down to 50 mV	None	- -	Direct thermocouple connections, on board linearize and CJC
ST-711 ST-732	32S / 16D	12 Bits	20 µs	x1 to x1 K Software	5V, 10V Down to 50 mV	2 (732)	12 Bits	On board start timer, Interrupt
ST-703	None	- -	- -	- -	2.5V to 10V 4 to 20 mA	4 Isolated	12 Bits	350V Isolation per channel
ST-724	None	- -	- -	- -	5V, 10V 4 to 20 mA	4	12 Bits	
ST-728	None	- -	- -	- -	5V, 10V 4 to 20 mA	4 or 8	12 Bits	
ST-716	None	- -	- -	- -	5V, 10V	4 or 8	16 Bits	
ST-705	8 D	13 Bits	33 ms	x1 to x200	4V Down to 20 mV	None	- -	RS-232 subsystem and CPU, Direct thermocouple connection, linearize, CJC
ST-519	TTL discrete I/O	- -	- -	- -	TTL	- -	- -	72 TTL lines, In/Out, Interrupt

PC/AT A/D-D/A BOARDS

Model	A/D Channels	A/D Resolution	A/D Speed	Prog. Gain Amplifier	In/Out Ranges	D/A Channels	D/A Resolution	Notes
PC-411A	16 S/8D	12 Bits	12 µs	x1 to x100	0 to +5V, ±5V 16 digit I/O	None	- -	FIFO memory, PC/XT/AT bus, timer/trigger, Simultaneous D/A DMA Interrupt
PC-411B	16 S/8D	14 Bits	14 µs	x1 to x100	0 to +5V, ±5V 16 digit I/O	None	- -	
PC-412A	16 S/8D	12 Bits	12 µs	x1 to x100	0 to +5V, ±5V 16 digit I/O	4	12 Bits	
PC-412B	16 S/8D	14 Bits	14 µs	x1 to x100	0 to +5V, ±5V 16 digit I/O	4	12 Bits	
PC-414A	4 SE w/simul sampling	12 Bits	1.5 MHz	x1 or x10	5V, 10V, 1V	1	12 Bits	4K-sample FIFO memory, analog trigger, parallel data port, counter/timer, DMA Vectored interrupt
PC-414B	4 SE	14 Bits	500 KHz	---	5V, 10V	1	12 Bits	
PC-414C	4 SE	12 Bits	1 MHz	---	5V, 10V	1	12 Bits	
PC-414D	1 SE	12 Bits	4 MHz	---	1V	1	12 Bits	
PC-414E	16 SE/8 D	12 Bits	500 KHz	x1 to x100	10V to 100 mV	1	12 Bits	
PC-430A	4 SE w/simul sampling	12 Bits	1.5 MHz	x1 or x10	5V, 10V, 1V	None	---	Local 32 MHZ 320C30 DSP, 512K memory,DMA Fast "no prgmg" command executive, DSP library, Vectored interrupt
PC-430B	4 SE	14 Bits	500 KHz	---	5V, 10V	None	---	
PC-430C	4 SE	12 Bits	1 MHz	---	5V, 10V	None	---	
PC-430D	1 SE	12 Bits	4 MHz	---	1V	None	---	
PC-430E	16 SE/8 D	12 Bits	500 KHz	x1 to x100	10V to 100 mV	None	---	
PC-462	4 Monitor Channels	12 Bits	25 KHz	---	0 to ±20V or 6V, 10W	2 Isolated, V or I mode	12 Bits	Programmable power DAC

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WIDE-RANGING, DC-DC POWER CONVERTERS

	Input (Vdc)	Output	Input Current No Load/Full Load	Output Noise & RIPPLE (Typ)	Efficiency (Min @ F.L.)	Line/Load Regulation	Model
NEW 20 WATT MODELS (2" x 2" x 0.45")	4.6 - 13.2V (5V, Nom)	3.3V,4.25 A	25 mA/3.78 A	50 mV p-p	75%	±0.2% / ±0.5%	**UWR-3.3/4250-D5**
	9.0 - 18V (12V, Nom)	3.3V,4.85 A	20 mA/1.77 A	50 mV p-p	76%	±0.2% / ±0.5%	**UWR-3.3/4850-D12**
	18 - 72V (48V, Nom)	3.3V,4.85 A	15 mA/0.422 A	50 mV p-p	79%	±0.2% / ±0.5%	**UWR-3.3/4850-D48**
	4.6-13.2V (5V, Nom)	5.0V,3.00 A	10 mA/3.79 A	50 mV p-p	80%	±0.2% / ±0.5%	**UWR-5/3000-D5**
	9.0 - 18V (12V, Nom)	5.0V,4.0 A	15 mA/2.032 A	50 mV p-p	82%	±0.2% / ±0.5%	**UWR-5/4000-D12**
	18 - 72V (48V, Nom)	5.0V,4.0 A	10 mA/0.505 A	50 mV p-p	82%	±0.2% / ±0.5%	**UWR-5/4000-D48**
	4.6 - 13.2V (5V, Nom)	12V, 1.25mA	75mA/3.75A	75mV p-p	80%	±0.2% / ±0.5%	**UWR-12/1250-D5**
	9.0 - 18V (12V, Nom)	12V, 1.65mA	45mA/1.96A	75mV p-p	84%	±0.2% / ±0.5%	**UWR-12/1650-D12**
	18 - 72V (48V, Nom)	12V, 1.65mA	25mA/0.99A	75mV p-p	82%	±0.2% / ±0.5%	**UWR-12/1650-D48**
	4.6 - 13.2V (5V, Nom)	15V, 1.00A	75mA/3.00A	75mV p-p	81%	±0.2% / ±0.5%	**UWR-15/1000-D5**
	9.0 - 18V (12V, Nom)	15V, 1.30A	45mA/1.94A	75mV p-p	84%	±0.2% / ±0.5%	**UWR-15/1300-D12**
	18 - 72V (48V, Nom)	15V, 1.30A	25mA/0.96A	75mv p-p	83%	±0.2% / ±0.5%	**UWR-15/1300-D48**
	4.6 - 13.2V (5V, Nom)	±5V, 1.5A	25mA/3.80A	25mV p-p	79%	±0.2% / ±1%	**BWR-5/1500-D5**
	9.0 - 18V (12V, Nom)	±5V, 1.7A	20mA/1.68A	75mV p-p	80%	±0.2% / ±1%	**BWR-5/1700-D12**
	18 - 72V (48V, Nom)	±5V, 1.7A	25mA/0.84A	75mV p-p	83%	±0.2% / ±1%	**BWR-5/1700-D48**
	4.6-13.2V (5V, Nom)	±12V,0.625 A	40 mA/1.829 A	75 mV p-p	82%	±0.2% / ±1%	**BWR-12/625-D5**
	9.0 - 18V (12V, Nom)	±12V,0.830 A	40 mA/2.00 A	75 mV p-p	84%	±0.2% / ±1%	**BWR-12/830-D12**
	18 - 72V (48V, Nom)	±12V,0.830 A	10 mA/0.508 A	75 mV p-p	82%	±0.2% / ±1%	**BWR-12/830-D48**
	4.6 - 13.2V (5V, Nom)	±15V,0.500 A	40 mA/1.829 A	75 mV p-p	82%	±0.2% / ±1%	**BWR-15/500-D5**
	9.0 - 18V (12V, Nom)	±15V,0.670 A	30 mA/1.587 A	75 mV p-p	84%	±0.2% / ±1%	**BWR-15/670-D12**
	18 - 72V (48V, Nom)	±15V,0.670 A	10 mA/0.508 A	75 mV p-p	82%	±0.2% / ±1%	**BWR-15/670-D48**
NEW, 10 WATT MODELS (2" x 1" x 0.375")	4.7 - 7.0V (5V, Nom)	3.3V,1.8 A	30 mA/1.715 A	50 mV p-p	70%	±0.2% / ±0.5%	**UWR-3.3/1800-D5**
	9.0 - 18V (12V, Nom)	3.3V,2.5 A	30 mA/0.915 A	50 mV p-p	75%	±0.2% / ±0.5%	**UWR-3.3/2500-D12**
	18 - 72V (48V, Nom)	3.3V,1.80 A	15 mA/0.170 A	50 mV p-p	75%	±0.2% / ±0.5%	**UWR-3.3/1800-D48**
	4.7 - 7.0V (5V, Nom)	5.0V,1.60 A	30 mA/2.160 A	50 mV p-p	74%	±0.2% / ±0.5%	**UWR-5/1600-D5**
	9.0 - 18V (12V, Nom)	5.0V,2.0 A	15 mA/1.03 A	50 mV p-p	81%	±0.2% / ±0.5%	**UWR-5/2000-D12**
	18 - 72V (48V, Nom)	5.0V,1.80 A	15 mA/0.240 A	50 mV p-p	78%	±0.2% / ±0.5%	**UWR-5/1800-D48**
	4.7 - 7.0V (5V, Nom)	12V,0.66 A	40mA/2.22A	75mV p-p	75%	±0.2% / ±0.5%	**UWR-12/655-D5**
	9.0 - 18V (12V, Nom)	12V,0.83A	35mA/1.00A	75mV p-p	81%	±0.2% / ±0.5%	**UWR-12/830-D12**
	18 - 72V (48V, Nom)	12V,0.75 A	10mA/0.26A	75mV p-p	82%	±0.2% / ±0.5%	**UWR-12/750-D48**
	4.7 - 7.0V (5V, Nom)	15V,0.53A	40mA/2.22A	75mV p-p	75%	±0.2% / ±0.5%	**UWR-15/530-D5**
	9.0 - 18V (12V, Nom)	15V,0.66A	35mA/0.99A	75mV p-p	82%	±0.2% / ±0.5%	**UWR-15/665-D12**
	18 - 72V (48V, Nom)	15V,0.60 A	10mA/0.26A	75mV p-p	83%	±0.2% / ±0.5%	**UWR-15/600-D48**
	4.7 - 7.0V (5V, Nom)	±5.0V,0.70 A	30 mA/1.842 A	50 mV p-p	76%	±0.2% / ±1%	**BWR-5/700-D5**
	9.0 - 18V (12V, Nom)	±5.0V,0.80 A	15mA/0.830 A	50 mV p-p	80%	±0.2% / ±1%	**BWR-5/800-D12**
	18 - 72V (48V, Nom)	±5.0V,0.70 A	10mA/0.185A	75mV p-p	78%	±0.2% / ±1%	**BWR-5/700-D48**
	4.7 - 7.0V (5V, Nom)	±12V,0.335 A	40 mA/2.1 A	15 mV p-p	76%	±0.2% / ±1%	**BWR-12/335-D5**
	9.0 - 18 (12V, Nom)	±12V,0.415 A	35 mA/1.00 A	25 mV p-p	83%	±0.2% / ±1%	**BWR-12/415-D12**
	18 - 72V (48V, Nom)	±12V,0.415 A	15 mA/0.260 A	50 mV p-p	80%	±0.2% / ±1%	**BWR-12/415-D48**
	4.6 - 13.2V (5V, Nom)	±15V,0.275 A	40 mA/2.142 A	15 mV p-p	77%	±0.2% / ±1%	**BWR-15/275-D5**
	9.0 - 18V (12V, Nom)	±15V,0.330 A	35 mA/0.992 A	25 mV p-p	84%	±0.2% / ±1%	**BWR-15/330-D12**
	18 - 72V (48V, Nom)	±15V,0.330 A	15 mA/0.257 A	50 mV p-p	81%	±0.2% / ±1%	**BWR-15/330-D48**
NEW, 3 WATT MODELS (1.25" x 0.8" x 0.435")	4.5 - 9.0V (5V, Nom)	5.0V,0.50 A	25 mA/0.714 A	100 mV p-p	70%	±0.2% / ±0.5%	**UWR-5/500-D5**
	9.0 - 18V (12V, Nom)	5.0V,0.50 A	15 mA/0.278 A	100 mV p-p	70%	±0.2% / ±0.5%	**UWR-5/500-D12**
	18 - 72V (48V, Nom)	5.0V,0.50 A	10 mA/0.069 A	100 mV p-p	75%	±0.2% / ±0.5%	**UWR-5/500-D48**
	4.5 - 9.0V (5V, Nom)	12V.0.25A	25mA/0.83A	75 mV p-p	72%	±0.2% / ±0.5%	**UWR-12/250-D5**
	9.0 - 18V (12V, Nom)	12V.0.25A	25mA/0.35A	75 mV p-p	72%	±0.2% / ±0.5%	**UWR-12/250-D12**
	18 - 72V (48V, Nom)	12V.0.25A	10mA/0.08A	75 mV p-p	75%	±0.3% / ±0.5%	**UWR-12/250-D48**
	4.5 - 9.0V (5V, Nom)	15V,0.20A	25mA/0.83A	75 mV p-p	72%	±0.2% / ±0.5%	**UWR-15/200-D5**
	9.0 - 18V (12V, Nom)	15V,0.20A	25mA/0.35A	75 mV p-p	72%	±0.2% / ±0.5%	**UWR-15/200-D12**
	18 - 72V (48V, Nom)	15V,0.20A	10mA/0.08A	75 mV p-p	75%	±0.3% / ±0.5%	**UWR-15/200-D48**
	4.5 - 9.0V (5V, Nom)	±12V,0.105 A	25 mA/0.714 A	75 mV p-p	70%	±0.2% / ±1%	**BWR-12/105-D5**
	9.0 - 18V (12V, Nom)	±12V,0.125 A	15 mA/0.333 A	75 mV p-p	75%	±0.2% / ±1%	**BWR-12/125-D12**
	18 - 72V (48V, Nom)	±12V,0.125 A	10 mA/0.076 A	75 mV p-p	82%	±0.2% / ±1%	**BWR-12/125-D48**
	4.5 - 9.0V (5V, Nom)	±15V,0.085 A	25 mA/0.729 A	75 mV p-p	70%	±0.2% / ±1%	**BWR-15/85-D5**
	9.0 - 18V (12V, Nom)	±15V,0.100 A	15 mA/0.333 A	75 mV p-p	75%	±0.2% / ±1%	**BWR-15/100-D12**
	18 - 72V (48V, Nom)	±15V,0.100 A	10 mA/0.076 A	75 mV p-p	82%	±0.2% / ±1%	**BWR-15/100-D48**

Datel

DATEL, Inc. 11 Cabot Boulevard, Mansfield, MA 02048-1194 • Telephone (508) 339-3000 • FAX (508) 339-6356

DATEL (UNITED KINGDOM) Tel: Basingstoke (256) 469-085
DATEL (FRANCE) Tel: (1) 3460-0101 DATEL (GERMANY) Tel: (89) 53-0741
DATEL (JAPAN) Tokyo Tel: (3) 3779-1031 Osaka Tel: (6) 354-2025

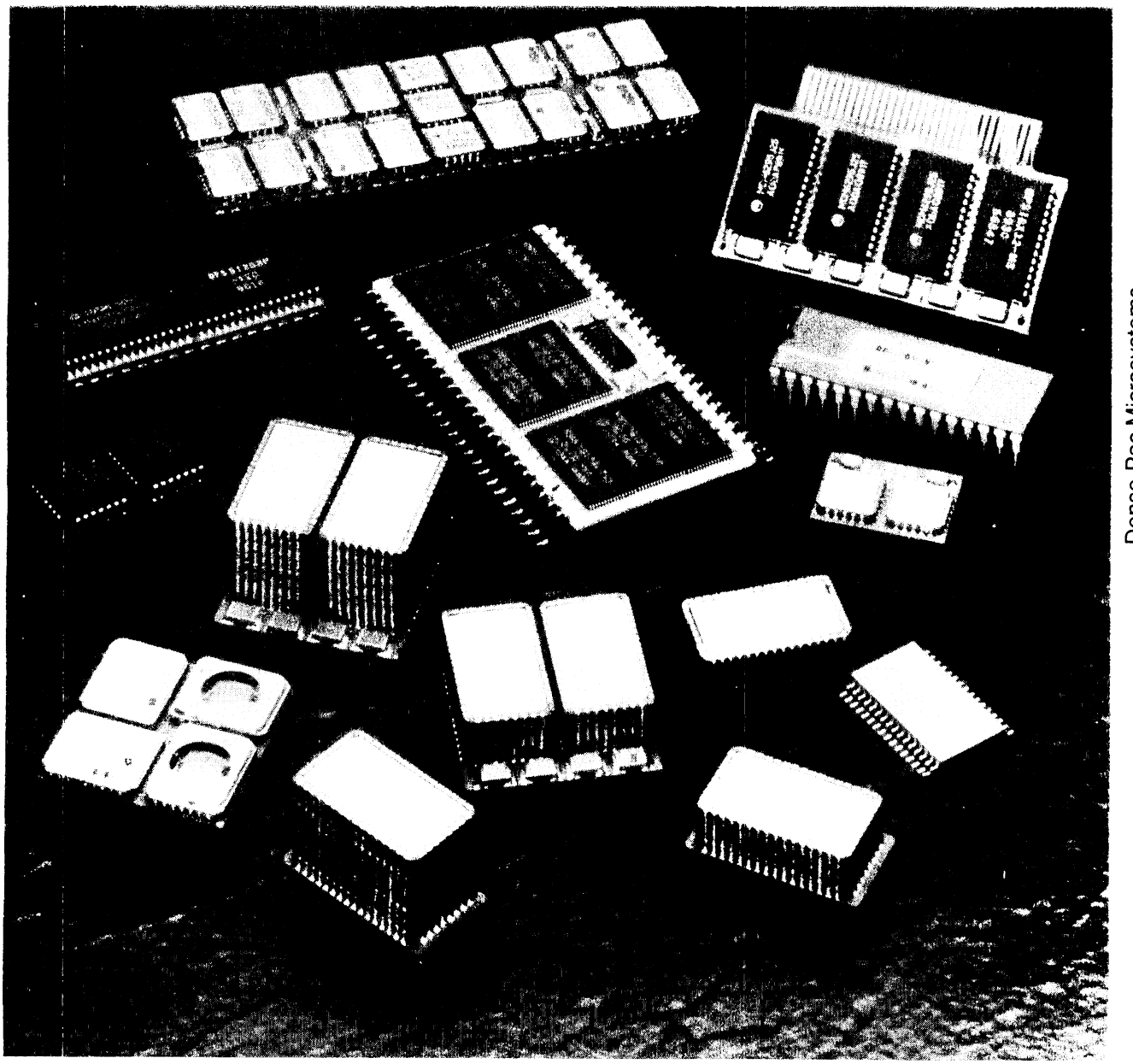
For Immediate Assistance:

1-800-233-2765

DENSE-PAC MICROSYSTEMS, INC.

Breaking Space Barriers

SHORT FORM CATALOG



Dense-Pac Microsystems

PRODUCTS

Standard and custom monolithic memories and memory/logic/analog modules manufactured since 1981.

DESIGN CAPABILITY

Dense-Pac digital and analog design engineers are in tune with your custom design requirements. We will work with you from conceptual design, through prototype, until you are satisfied with the custom part in its application. Dense-Pac's CAD system can provide short design cycles. Combined with our designers' experience in optimizing module performance in terms of minimizing parasitic impedances, Dense-Pac can supply a turn key product in an abbreviated turn-around time. Modules may be designed using PCB, thick film or co-fired ceramic substrates in DIP, SIP, ZIP or PGA configurations. Dense-Pac also has 3-dimensional packaging techniques which can be designed into custom applications where board space savings is paramount. With 10 years of custom module design behind us, we are fully prepared to satisfy your every need from circuit design to thermal analysis.

TEST CAPABILITY

Dense-Pac has made major investments in both automated test equipment (ATE) and in test software engineering. Six modern ATE testers are supplemented with two functional testers, all with temperature forcing capabilities. Attention is paid to every detail, such as measuring the exact case temperature of each module under test. To further assure the highest quality parts, limits on critical parameters are not just set at data sheet values but set at product design values to eliminate parts falling outside the normal distribution. All Dense-Pac manufactured monolithic devices are 100% parametrically tested at temperature, standard modules are 100% functionally tested at temperature. All non-standard/custom modules are tested per customer request, and all are functionally tested over temperature and fully warranted to meet specifications.

MILITARY PROCESSING CAPABILITY

Dense-Pac has full test, burn-in and environmental test capabilities to process product in accordance with the following methods from MIL-STD-883C:

Screening Capabilities

Internal Visual per Method 2010, Test Condition B
Temperature Cycle per Method 1010, Test Condition C
Thermal Shock per Method 1011, Test Condition A
Constant Acceleration per Method 2001, Test Condition E; Y1 orientation only
Three-Temperature Testing per Dense-Pac Specification or Customer S.C.D.
P.I.N.D. (optional) per Method 2020, Test Condition A
Burn-In per Method 1015, 160 Hrs. @ +125°C
Seal (Fine and Gross Leak) per Method 1014
External Visual per Method 2009

Qualification and Quality Conformance Inspection Capabilities

Resistance to Solvents per Method 2015
Solderability per Method 2022 or 2003
Bond Strength per Method 2011
Steady State Life Testing per Method 1005
Physical Dimensions per Method 2016
Lead Integrity per Method 2004 Test Condition B2 (Lead Fatigue)
Moisture Resistance per Method 1004
Mechanical Shock per Method 2002, Test Condition B
Vibration, Variable Frequency per Method 2007, Test Condition A
Salt Atmosphere per Method 1009, Test Condition A
Internal Water Vapor Content per Method 1018, 5000 ppm max. H_2O content @ +100°C

QUALITY

Dense-Pac has an absolute commitment to quality which is evident by the results of our 100% pass rate for military vendor quality surveys to MIL-I-45208. Dense-Pac has been approved as a MIL-I-45208 vendor by over 20 major U.S. defense and aerospace prime contractors and by several major overseas corporations. Dense-Pac Quality Assurance reviews all purchase orders, customer specifications, and any other applicable documentation against our drawings, test software, test procedures, travelers, etc. for each customer order. Dense-Pac maintains a complete MIL-I-45208 system for all products produced (Commercial, Industrial, and Military grades). Dense-Pac's quality system, including a complete configuration management system, has been extremely successful, evident by our level of customer satisfaction and an extremely low product return rate.

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Dense-Pac Microsystems

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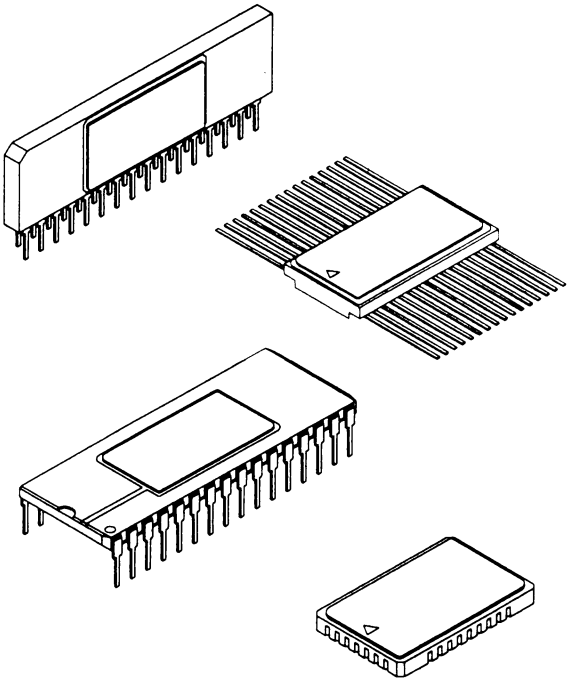
DPS128M8
CERAMIC 128K X 8 CMOS MONOLITHIC SRAM



Description

The DPS128M8 is a 128K x 8 asynchronous static RAM fabricated on a monolithic CMOS chip. It is designed for use in high-density, high-speed, low-power applications. All pins are TTL-compatible and a single +5 Volt power supply is required.

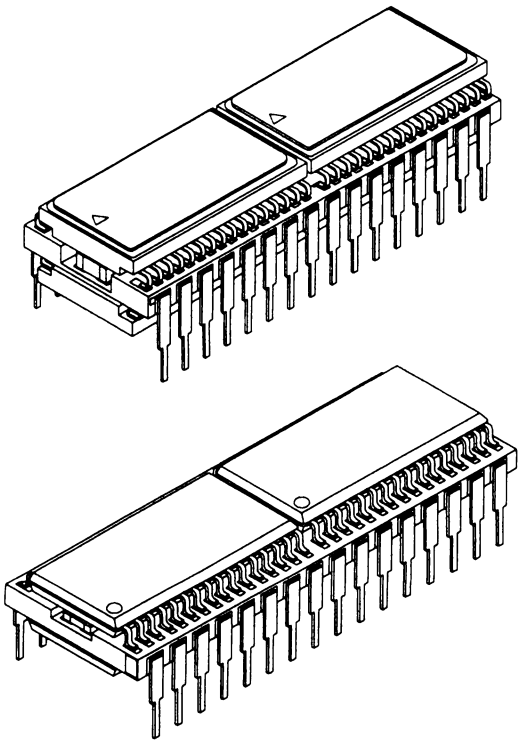
The DPS128M8 has extremely low standby power dissipation making it suitable for battery back up.

The 600-mil wide, 32-pin ceramic, dual-in-line package conforms to the JEDEC standard. Dense-Pac also offers the DPS128M8 as a space saving ceramic ZIP, ceramic leadless chip carrier and ceramic Small Outline Gullwing "flatpack" for surface-mount applications.

All Dense-Pac military monolithic packages are available screened to selected test methods from MIL-STD-883, which are further described in the Military Processing Capability section.

Features

- 131, 072 word by 8-bit organization
- Fast Access Times: 70, 85, 100, 120, 150ns
- Higher Speed (25ns to 55ns) Available 2H'91
- Low Power Dissipation - 10 µW (typ.) standby
  75 mW (typ.) operating
- 2-Volt Data Retention
- Output Enable Function
- Two Chip Enables



DPS512S8
512K X 8 CMOS SRAM MODULE
(Military and Commercial)

Description

The DPS512S8P/N is a 512K X 8 high-density, low-power static RAM module comprised of four 128K X 8 monolithic SRAM's, advanced, high-speed CMOS decoder and decoupling capacitors surface mounted on a co-fired ceramic substrate having side-brazed leads.
The DPS512S8P/N is available in a 600-mil-wide, 32-pin dual-in-line package that conforms to the same JEDEC standard pin configuration as the future JEDEC four megabit monolithics.
The DPS512S8P/N operates from a single +5V supply and all input and output pins are completely TTL-compatible. The low standby power of the DPS512S8P/N make it ideal for battery-backed applications.
Military modules are available using components screened to selected test methods from MIL-STD-883, which are further described in the Military Processing Capability section.

Features

- 524, 288 word by 8 bit configuration
- Fast Access Times: 45, 55, 70, 85, 100, 120, 150ns
- Low Power Dissipation - 40 µW (typ.) standby
  80 mW (typ.) operating
- 2-Volt data retention
- 600 mil, 32-pin JEDEC standard DIP pinout
- Fully Static Operation - No clock or refresh required
- All Inputs and Outputs are TTL-compatible

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Dense-Pac Microsystems

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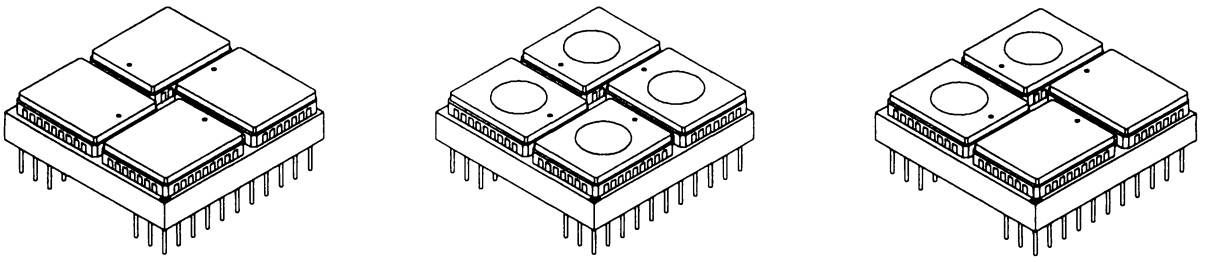
VERSAPAC OFFERS 32-BIT WIDE MEMORY IN ONE SQUARE INCH
SRAM / EPROM / EEPROM / FLASH EEPROM



The VERSAPAC series of memory modules consist of SRAM, EPROM, EEPROM or Flash EEPROM devices surface mounted on a co-fired ceramic PGA substrate. The VERSAPAC can be a heterogeneous combination of technology such as SRAM/EPROM or SRAM/EEPROM; or a homogeneous configuration of SRAM, EPROM, EEPROM or Flash EEPROM, on one substrate. The 32-bit wide architecture is ideal for use with the latest microprocessors and digital signal processors. The module can also be addressed in 8, 16 or 24 bit words.

Standard components available for use on the Versapac are:

SRAM	128Kx8, 32Kx8 and 8Kx8
EPROM	128Kx8 and 32Kx8 (64Kx8 in homogeneous only)
EEPROM	128Kx8, 32Kx8 and 8Kx8
Flash EEPROM	128Kx8 (64Kx8 in homogeneous only)

Dense-Pac Microsystems

Advantages

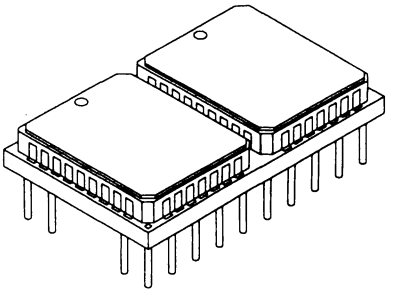
- 32-bit wide architecture.
- Most combinations of SRAM, EPROM, EEPROM or Flash EEPROM can be mixed on the same module while the pin-out connections remain constant.
- 66-PIN PGA
- Includes four 0.1µF on board bypass capacitors.
- Central lower gap can accommodate a heat rail if desired.
- Each memory device on the module can be accessed independently with its own chip enable.
- EPROM programming adaptors are available.

NEW HALF-VERSAPACS FOR 16-BIT WIDE APPLICATIONS

The new Halfpac family of memory modules from Dense-Pac offer the same board densities and flexibility as our Versapacs, but are intended for 8 and 16-bit wide applications. Like the Versapac, a mixture of technology can be integrated on the same module (one 32Kx8 SRAM with one 128Kx8 EPROM for example), as well as 16 bits of a single technology .

Features:

- 16-bit data width.
- Supports a mixture of SRAM, EPROM, EEPROM, or FLASH EEPROM on the same module.
- 40-Pin PGA (1.009" x 0.596")
- Central 0.3" gap on the underside can accomodate a heat rail if desired.
- Each memory device can be accessed individually.



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DENSE-PAC Microsystems, Inc.
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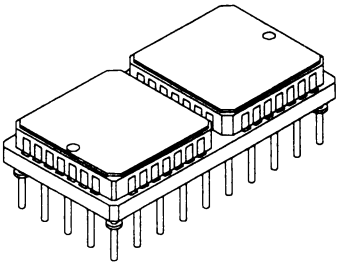
REDUCE YOUR PLD BOARD SPACE
DENSE-PAC'S PROGRAMMABLE LOGIC MODULE

The Dense-Pac Programmable Logic Module (DPLD) is a 48-pin Pin Grid Array (PGA) designed to support two "22V10" field programmable array logic, 22 input, 10 macrocell output devices (DPL22V10A), including decoupling capacitor, at a 50% board space savings over conventional though hole (DIP) technology. Standard Electrically Erasable (E^2), One Time Programmable (OTP) and UV erasable devices are available. Complete programmability and functional access are maintained for both devices.

The DPLD can be used to save board space with other standard PLD's, typically used in 24-Pin DIP packages and available in 28-pad LCC's, by mounting them on the module.

The DPLD module is available for military use with semiconductor components manufactured in compliance with MIL-STD-883, Class B, making it ideally suited for use in the most demanding applications requiring the highest levels of reliability and performance.

- Adapts Two Standard 22V10 PLD's in One Package
- 50% Board Space Reduction
- Easily Programmable Using Standard Equipment and Program Adapter
- Includes On Board Decoupling Capacitor
- Available in Standard CMOS E^2, OTP and UV Erasable
- Separate Clock/ Programming Inputs
- Measures Only 0.495 x 0.990 inches
- Speeds as fast as 25ns and faster as those devices become available



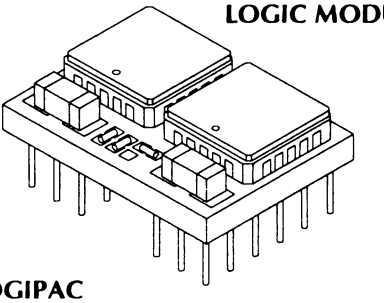
DENSE-PAC LOGIC MODULES SAVE 35% OR MORE BOARD SPACE

The Dense-Pac Logic Module (DPL's) are a family of memory support modules available in 16-bit or dual 8-bit configurations. The DPL family will save from 35% to 50% of the logic board space typically populated by standard 20-pin DIP packages, permitting a tighter, more compact final design. The DPL's are available to support all logic families: "FCT", "F", "ACT", "HC", "HCT", "LS" and others. Various module types include dual buffers/drivers, transceivers, registers, latches, and other types of logic.

The DPL module is available for military use with semiconductor components manufactured in compliance with MIL-STD-883, Class B, making it ideally suited for use in the most demanding applications requiring the highest levels of reliability and performance.

- 35% To 50% Board Space Savings vs. Conventional DIP Packages
- Buffers/Drivers
- Transceivers
- Registers
- Latches
- Other Standard Logic Devices
- Includes On Board Decoupling Capacitors
- Pin Grid Array (PGA) Package
- CMOS and/or TTL Compatible

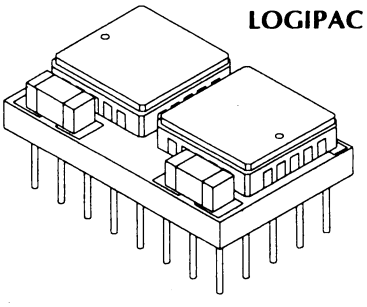
LOGIC MODULE



LOGIC MODULE

- 16 Bit Logic Support
- 35% (min.) Board Space Savings (0.590" x 0.790")
- Common Clock/Control Lines
- Heat Rail Accomodating Central Gap
- Ideal for 16 and 32 Bit Buffering

LOGIPAC



LOGIPAC

- 8 and 16 Bit Logic Support
- 50% (min.) Board Space Savings (0.490" x 0.790")
- Homogeneous/Heterogeneous Configurations
- Separate Control/Clock Lines
- Mix Logic for Your Custom Application

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DENSE-PAC Microsystems, Inc.
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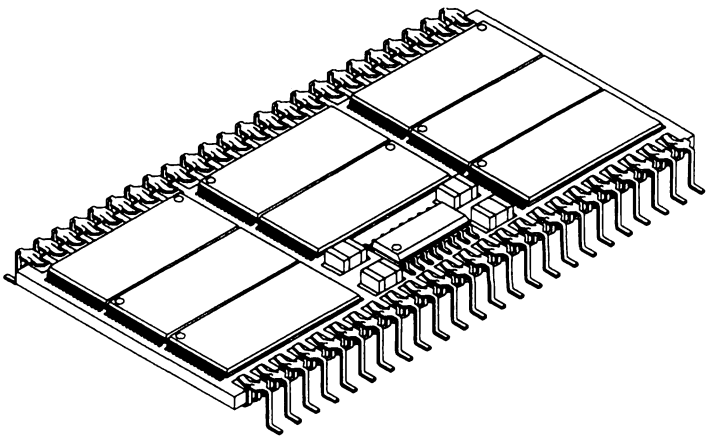
16 Megabit SRAM Module in Surface Mount or DIP Package!

Description

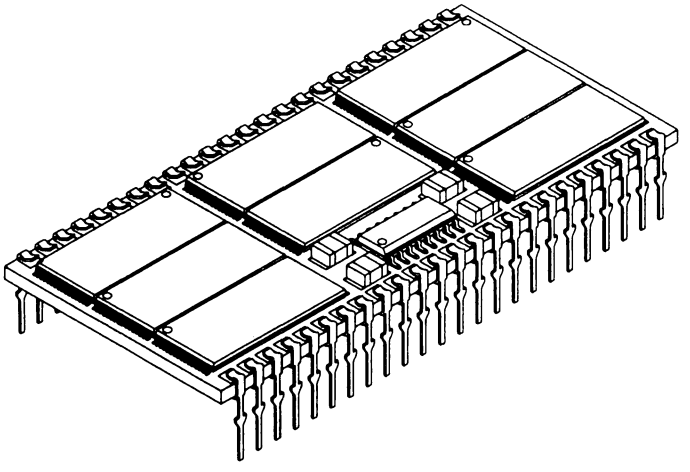
The DPS1MS16P/XP is a 2048K x 8 or 1024K x 16 bit high-density, low-power static RAM module consisting of 16 individual, ultra low-power, 128K x 8 CMOS SRAMs packaged in Thin Small Outline Packages (TSOPs).

By using TSOPs and advanced surface-mount techniques, the Dense-Pac DPS1MS16P/XP memory module offers high density packaging for both surface mount and through-hole applications. The low power RAMs are capable of retaining data at only two volts while drawing typically only 16 µA of current making the DPS1MS16P/XP ideal for battery backed applications.

The DPS1MS16P/XP is the first in a family of commercial grade memory modules that takes advantage of the space savings gained by employing TSOP packages.



Dense-Pac Microsystems



Features

- 1024K by 16 or 2048K by 8 Bit Configuration
- Fast Access Times: 85, 100, 120, 150ns
- Low Power CMOS Design
- 2-Volt Data Retention
- 48-pin Flat Pack or Dual-Inline Package
- All Inputs and Outputs TTL Compatible
- Industrial Screening Available
- 2.50" x 1.20" x 0.24"

NOTE FOR SURFACE MOUNT VERSION: The module's ceramic substrate allows the use of a high temperature solder (240°C for mounting the TSOP components and 300°C for lead attach) in constructing the module. This assures that the module will not itself re-flow during the process of attaching it to a surface mount P.C.B.

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DENSE-PAC Microsystems, Inc.
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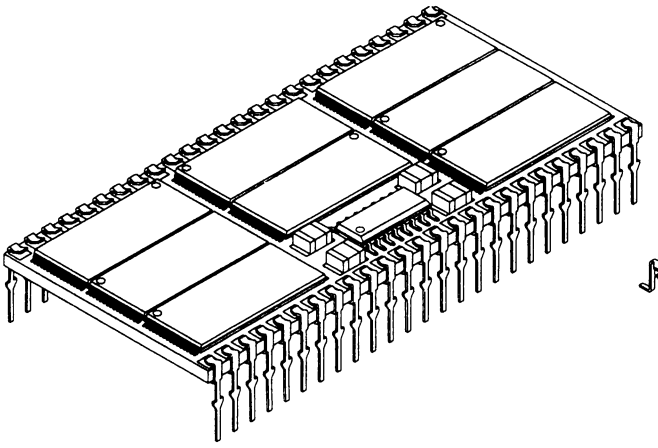
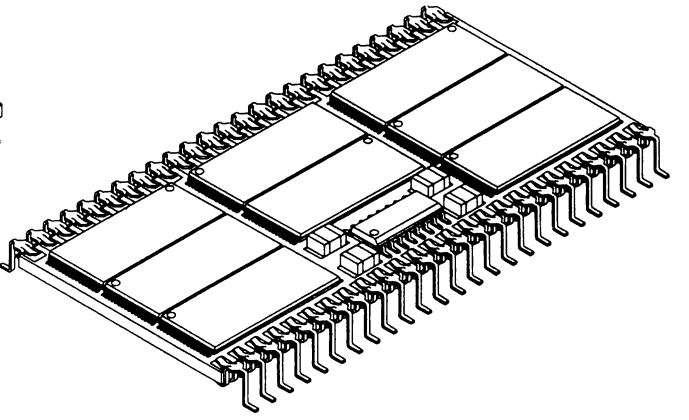
16/32 Megabit FLASH EEPROM Module in Surface Mount or DIP Package!





Description

The DPZ1MS16P and DPZ2MS16P are 16 megabit and 32 megabit respectively, CMOS FLASH Electrically Programmable and Erasable nonvolatile memory modules. The module is built with sixteen, 128K x 8 (DPZ1MS16P) or sixteen 256K x 8 (DPZ2MS16P) FLASH memory devices and 2 high speed decoders. The DPZ1MS16P can be user configurable as 1024K x 16 or 2048K x 8 bits, while the DPZ2MS16P can be user configurable as 2048K x 16 or 4096K x 8 bits.

By using TSOPs and advanced surface-mount techniques, the Dense-Pac DPZ1MS16P is able to attain a density of over 5 Megabits per square inch of board space while maintaining a low profile (0.200" max.) and the DPZ2MS16P is able to attain a density of over 10 Megabits per square inch. The modules are available with either through-hole leads (DPZ1MS16P/DPZ2MS16P), or surface mount leads (DPZ1MS16XP/DPZ2MS16XP).

The DPZ1MS16P and DPZ2MS16P are ideal for use in systems that require periodic code updates, or for use as a high speed nonvolatile storage medium.

Features

- Organizations:
  1024K x 16 or 2048K x 8 (DPZ1MS16P/XP)
  2048K x 16 or 4096K x 8 (DPZ2MS16P/XP)
- Fast Read Access Times:
  150, 200, 250ns (DPZ1MS16P/XP)
  200, 250, 300ns (DPZ2MS16P/XP)
- Low Power:
  75mA Maximum Active (16 bit Mode)
  45mA Maximum Active (8 bit Mode)
  1.6mA Maximum Standby
- 10,000 Erase/Program Cycles Minimum
- Command Register Architecture for Microprocessor Compatible Write Interface
- 12.0V ± 5% V_{PP}
- TTL Compatible Inputs and Outputs
- 50-pin Flat Pack or Dual-Inline Package
- 2.50" x 1.20" x 0.24"

NOTE FOR SURFACE MOUNT VERSION: The module's ceramic substrate allows the use of a high temperature solder (240°C for mounting the TSOP components and 300°C for lead attach) in constructing the module. This assures that the module will not itself re-flow during the process of attaching it to a surface mount P.C.B.

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Dense-Pac Microsystems

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Dense-Pac Introduces 3-Dimensional Memory Packaging

New from Dense-Pac Microsystems is a family of memory modules using a three dimensional memory packaging technique enabling densities of over 4 Megabytes in approximately one square inch. This technique can increase board densities by a factor of 40 to 1 over conventional monolithic packages, and 10 to 1 over standard two-dimensional memory module designs.

Dense-Pac's 3-D packaging technology is based on a Stackable Leadless Chip Carrier or SLCC. By stacking memory vertically, the highest possible densities are achieved while also increasing performance by keeping trace lengths as short as possible. Stacking also allows for expanding memory depth while maintaining the same footprint.

Currently, each SLCC contains low-power CMOS 128K x 8 static RAM or Flash EEPROM die. In the future Dense-Pac plans to offer SLCC modules with other technologies. Because each SLCC is hermetically sealed and environmentally screened, modules built with SLCCs are suitable for almost any application.

These new stackable modules are designed to be very mechanically rugged and can withstand harsh environmental test requirements such as temperature cycling, mechanical shock, vibration testing, constant acceleration testing and operation over extended temperature ranges (-55°C to +125°C).

Because the SLCCs and the module substrate are both made of ceramic, there are no problems associated with thermal stress on the module over temperature due to differing thermal coefficients of expansion. Also, because Dense-Pac carefully selects only low-power CMOS devices, the modules run cool. Modules built with SLCCs, and modules in general, have many advantages over hybrids such as individual device testing, screening and the ability to rework. Dense-Pac offers a family of standard modules using 3-D packaging in a variety of densities and data path widths. Modules for 8, 16, 24, and 32-bit wide applications are available in densities from 128K to 3-Mbit deep as standard products. If one of the standard configurations does not suit a specific application, Dense-Pac can build a custom module with SLCCs to suit individual requirements.

Dense-Pac Microsystems

General Dense-Stack Features:

- Static RAM and FLASH EEPROM
- 32 Megabit per Square Inch Density !
- Memory is Expandable by Adding More Layers While Keeping the Same Footprint
- Low Power CMOS Designs
- High Performance Due to Short Trace Lengths (lower capacitance and inductance)
- Modules are Repairable
- 8, 16, 24, and 32-Bit Wide Data Paths

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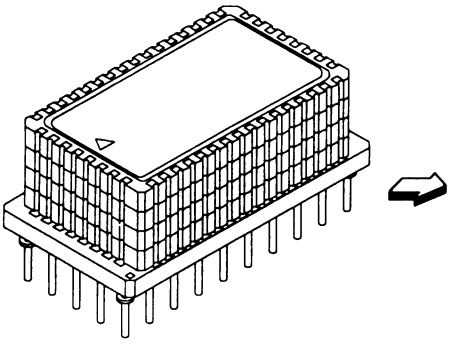
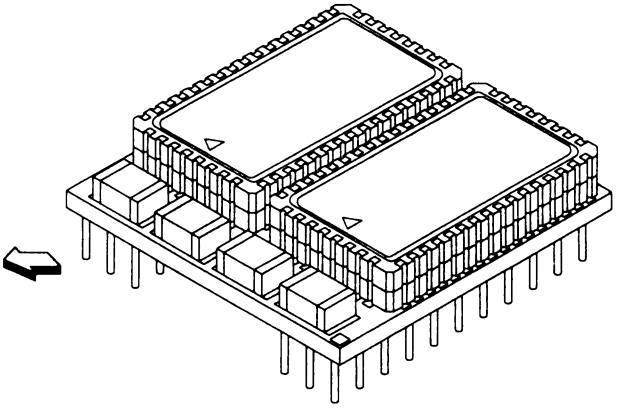
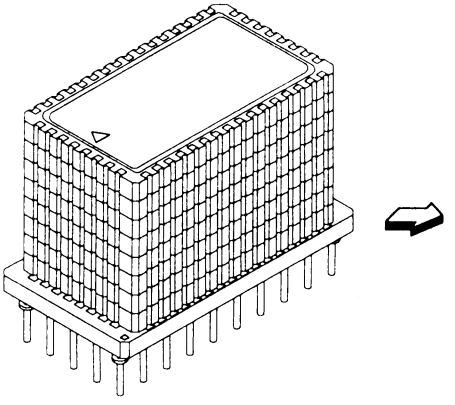
Examples of the New Dense-Stack STATIC RAM and Flash EEPROM Module Family



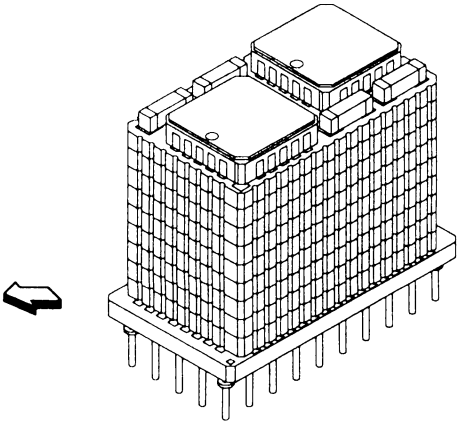
FEATURES:
- Static RAM Organizations Available: 256K x 16 or 512K x 8
- Static RAM Access Times: 20ns - 150ns
- Flash EEPROM Organization: 512K x 16 or 1M x 8
- Flash EEPROM Access Times: 120ns - 200ns
- 50 - Pin Grid Array "DENSE-STACK" Package
- 0.99" x 0.54" Footprint



FEATURES:
- Static RAM Organizations Available: 128K x 32, 256K x 16 or 512K x 8
- Static RAM Access Times: 20ns - 150ns
- Flash EEPROM Organization: 256K x 32, 512K x 16 or 1M x 8
- Flash EEPROM Access Times: 120ns - 200ns
- 66 - Pin Grid Array "VERSA-STACK" Package
- 1.10" X 1.10" Footprint



FEATURES:
- Static RAM Organizations: 512K x 16, or 1M x 8
- Static RAM Access Times: 20ns - 150ns
- Flash EEPROM Organization: 1M x 16 or 2M x 8
- Flash EEPROM Access Times: 120ns - 200ns
- 50 - Pin Grid Array "DENSE-STACK" Package
- 0.99" x 0.54" Footprint



FEATURES:
- Static RAM Organization: 1M x 8
- Static RAM Access Times: 20ns - 150ns
- Buffered and Decoded
- 50 - Pin Grid Array "DENSE-STACK" Package
- 0.99" x 0.54" Footprint

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STACKING TECHNOLOGY VITAL STATISTICS

	DENSE-STACK		VERSA-STACK	
	SRAM	FLASH EEPROM	SRAM	FLASH EEPROM
SPEEDS (ns)	20ns - 150ns	120ns - 350ns	20ns - 150ns	120ns - 350ns
DIMENSIONS (inches):	(W x L x H)	(W x L x H)	(W x L x H)	(W x L x H)
2 MEGABITS	0.540 x 0.990 x 0.292	0.540 x 0.990 x 0.214	1.090 x 1.090 x 0.194	1.090 x 1.090 x 0.204
4 MEGABITS	0.540 x 0.990 x 0.468	0.540 x 0.990 x 0.312	1.090 x 1.090 x 0.282	1.090 x 1.090 x 0.204
8 MEGABITS	0.540 x 0.990 x 0.820	0.540 x 0.990 x 0.508	1.090 x 1.090 x 0.458	1.090 x 1.090 x 0.302
16 MEGABITS	N/A	0.540 x 0.990 x 0.900	1.090 x 1.090 x 0.810	1.090 x 1.090 x 0.498
24 MEGABITS	N/A	N/A	N/A	1.090 x 1.090 x 0.890
AREA (square inches.):	0.535	0.535	1.188	1.188
VOLUME (cubic inches):				
2 MEGABITS	0.156	0.114	0.230	0.242
4 MEGABITS	0.250	0.167	0.335	0.242
8 MEGABITS	0.438	0.272	0.544	0.359
16 MEGABITS	N/A	0.481	0.962	0.592
24 MEGABITS	N/A	N/A	N/A	1.057
VOLUME (cc):				
2 MEGABITS	2.56	1.87	3.78	3.97
4 MEGABITS	4.10	2.73	5.49	3.97
8 MEGABITS	7.18	4.45	8.92	5.88
16 MEGABITS	N/A	7.88	15.77	9.70
24 MEGABITS	N/A	N/A	N/A	17.33
WEIGHT (grams):				
2 MEGABITS	5.8	4.3	8.4	8.7
4 MEGABITS	9.1	6.1	11.7	8.7
8 MEGABITS	15.7	9.7	18.3	12.3
16 MEGABITS	N/A	16.9	31.5	19.5
24 MEGABITS	N/A	N/A	N/A	33.9
CURRENT - OPERATING (mA)(typical)				
256Kx8	46	26	46	26
128Kx16	90	50	90	50
512Kx8	48	28	48	28
256Kx16	92	52	92	52
128Kx32	N/A	N/A	180	100
1Mx8	52	32	52	32
512Kx16	96	56	96	56
256Kx32	N/A	N/A	184	104
2Mx8	N/A	40	60	40
1024Kx16	N/A	64	104	64
512Kx32	N/A	N/A	192	112
3Mx8	N/A	N/A	N/A	48
1.5Mx16	N/A	N/A	N/A	72
768Kx32	N/A	N/A		120
CURRENT - STANDBY (µA)(typical)				
2 MEGABITS	4	40	4	40
4 MEGABITS	8	80	8	80
8 MEGABITS	16	160	16	160
16 MEGABITS	N/A	320	32	320
24 MEGABITS	N/A	N/A	N/A	480

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VERSA-STACK SHOCK AND VIBRATION DATA

Five samples of DPS512X32V3 Versa-Stacks, consisting of two 8-high stacks *(2 megabytes)*, were subjected to, and passed, the following tests:

> Mechanical shock as per MIL-STD-883 Method 2002.3, Condition B *(1500 G for 0.5ms in the X1, X2, Y1, Y2, Z1, Z2 orientaion).*

> Vibration, variable frequency as per MIL-STD-883 Method 2007.1, Condition A *(20 G peak acceleration in the X, Y, Z orientation).*

VERSA-STACK THERMAL ANALYSIS

The following is a thermal analysis of the 2M-BYTE VERSA-STACK *(16, 128K x 8 SLCC's configured as two 8-high stacks on a substrate).*

$$\theta_{JC} = 10^{\circ}C/watt$$

NOTE: This was empirically determined using a forward biased junction on the active chip as a thermocouple and is identical to the number published in **MIL-STD-38510** for this package and die size.

$$\theta_{CA} = 30^{\circ}C/watt$$

NOTE: This was empirically determined by thermocouple measurements of the case temperature while applying measured amounts of power to the module.

$$\theta_{JA} = \theta_{JC} + \theta_{CA} = 40^{\circ}C/watt$$

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Stacked Chips = More Memory

Self-contained chip carriers save valuable board space, says John Forthun.

Lyle H. McCarty, Western Editor

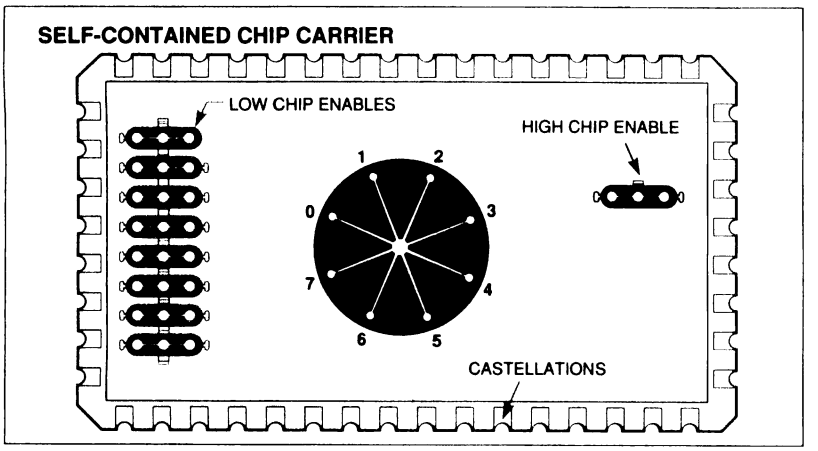
Garden Grove, CA—Electronics engineers are busy packing more and more components into ever-smaller spaces. In particular, static random access memory (SRAM) banks are greatly expanding, and squeezing them into the available space poses some engineering challenges.

Typical solutions involve mounting additional SRAM modules on the PC boards, and using both sides of the board. While the second approach comes close to halving the required board area, memory size is increasing by an order of magnitude in some instances, so there's still a problem.

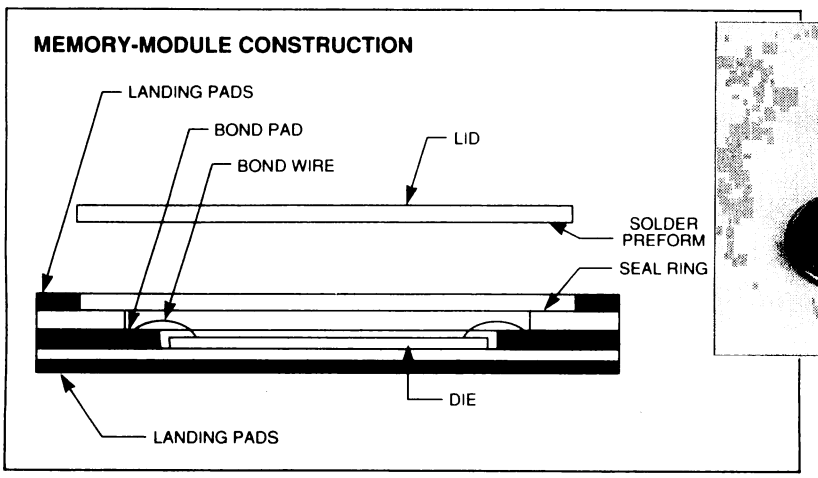
A new design, based on a Stackable Leadless Chip Carrier (SLCC), provides much more memory capacity for a given amount of PC board area. Using it can reduce the required board space by a factor of 40 compared to conventional designs. Each ceramic chip carrier contains an hermetically sealed die with-burned-in IC. Stacking the SLCCs into a memory module creates the desired circuit subsystem.

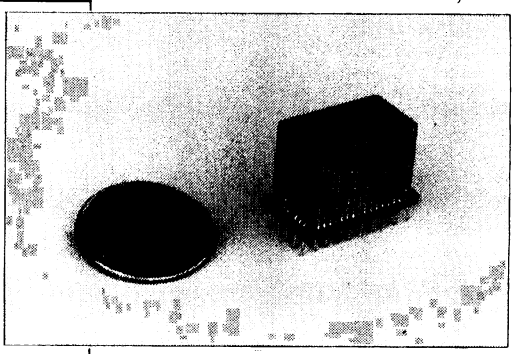
Stacking is accomplished by aligning several carriers and then tin dipping each of the assembly's four sides. Tin flows onto the conductive metalized land pads located on both top and bottom surfaces of the SLCC, and fills each castellation. Bridging the three-to-six-mil gap between SLCCs, the tin provides a strong mechanical joint, electrical connection, and thermal path. The gap between layers permits flushing to remove flux residue remaining after tin dipping.

Single- and two-stack memory modules afford memory capacities that vary according to the number of SLCCs that are stacked. As many as 16 SLCCs can be stacked, al-



Memory die is hermetically sealed in a stackable leadless chip carrier. Before assembly, all but one of the LOW CHIP ENABLE leads (spokes on wheel shown here) are severed to provide the desired circuit configuration.





Individual SLCCs, stacked and soldered together, form the SRAM memory module. Inset: A stack of eight chip carriers packs eight megabits of static RAM in 0.54 square inch. Height is just 0.75 inch.

"The SLCC's three-dimensional approach increases memory density far beyond what was formerly possible."

—John Forthun

though four-and eight-SLCC stacks are more common. Each SLCC's LOW CHIP ENABLE is easily configured to one of eight different terminal pads; the HIGH CHIP ENABLE and Data I/Os can be configured for either of two pads.

The ability to arrange the SLCC for different pinouts makes stacking applicable to a variety of memory systems.

"The SLCC's three-dimensional approach increases memory density far beyond what was formerly possible," says John Forthun, design engineering manager of Dense-Pac Microsystems. "That's extremely important given the increased complexity and sophistication of today's circuit designs."

Greater memory density can reduce the size and number of PCBs as well as the number of vias, and trace lengths, for faster data transmission. Forthun points to other advantages as well: SLCCs offer better electrical performance due to extremely short interconnects. Components can be tested and screened before assembly; and the stackable design is suited to retrofit circuit applications.

Additional details contact ... John Forthun, Dense-Pac Microsystems, Inc., 7321 Lincoln Way, Garden Grove, CA 92641, (714) 898-0007. □

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- Dynamic Memory systems
- EEPROM memory systems
- Logic systems with high degrees of parallel I/O (multiplexers, buffers, etc.)

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FAX:	Date Required:

MODULE INFORMATION

1.	Type: *(SRAM, EEPROM, EPROM Flash, etc.)*	
2.	Amount of Memory per Module:	
3.	Amount of Memory per Board/System:	
4.	Speed:	
5.	Grade: *(Commercial, Military, etc):*	
6.	Width of Data Bus:	
7.	Special Test Requirements:	
8.	Special Power Requirements:	
9.	Board Space: *(L x W x H)*	
10.	Form Factor: *(DIP, PGA, F/P, ZIP, etc.)*	
11.	Application:	
12.	Quantity / yr.: *(Boards / Systems)*	
13.	Delivery / Time Frame:	
14.	Special Configuration Information: *(Attach)*	
15.	Other:	

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Dense-Pac Microsystems

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New High Density and High Speed SRAMs for High Performance Systems

Electronic Designs Incorporated is a leading international supplier of high-performance, high-reliability Static RAM products to all segments of the electronic equipment industry, including many of the worlds largest makers of computer systems, peripherals, and telecommunications hardware.

New product development has been stepped up to add *faster* standard asynchronous Static RAMs, high performance synchronous and special feature/microprocessor specific Static RAMs and high density memory subsystems. Product information and samples are available ***now***.

High Speed Monolithic Static RAMs

Density	Org	Part Number	Description	Speeds (ns)	Max Current Consumption ICC1 mA	ICC3 mA	IDR µA
1M	128Kx8	EDI88128CS	Single Chip Enable	20-35	225	5/2*	750**
1M	128Kx8	EDI88130CSA	Dual Chip Enable	17-35	150	5/1*	500**
1M	256Kx4	EDI84256CS	Common I/O	20-25	225	5/2*	750**
1M	256Kx4	EDI84256CSA	Common I/O	17-35	150	5/1*	500**
1M	256Kx4	EDI84258CSA	Separate I/O	17-35	150	5/1*	500**
1M	1Mx1	EDI811024CSA		17-35	150	5/1*	500**
256K	32Kx8	EDI8834CA		12-20	165	1	
256K	64Kx4	EDI8465CA		12-20	165	1	
256K	64Kx4	EDI8466CA	Output Enable Function	12-20	165	1	

**P and LP Versions, eg. EDI88128PS or EDI88128LPS; **LP Version only, eg.EDI88128LPS*

New Synchronous and Special Feature Static RAMs

EDI's New Synchronous SRAMs are designed for use as first- or second-level cache in high performance CISC and RISC based systems.

Synchronous SRAMs combine traditional SRAM operations with Input/Output registers, clock operation and self-timed circuitry to provide more cost effective cache solutions for these high performance µProcessors.

Special Feature SRAMs combine Asynchronous SRAM cores with latches, buffers, and high speed drivers to provide ease of integration and reduce part counts from traditional memory array designs.

Monolithic Synchronous & Special Feature SRAMs

Density	Org	Part Number	Description	Speeds (ns)	Max Current ICC1 mA	ICC2 mA	Package Leads/Style
1M	64Kx16/18	EDI82997C	Asynchronous/Latched Address	20-25	240	40	52/PLCC
1M	32Kx32	EDI82232C	Synchronous	14-30*	425	40	68/PLCC
1M	32Kx32	EDI82132C	Asynchronous/Latched Address	12-20	425	40	68/PLCC
256K	16Kx16	EDI82157C	SPARC	15-33	180		52/PLCC
256K	16Kx16	EDI82158C	SPARC	15-33	180		52/PLCC

** Cycle Time, Clock High to Clock High*

SPARC™ is a trademark of Sun Microsystems, Inc.

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The Cost Effective Solution to the Need for High Density
High Performance FR-4 Based Modules

A pioneer in memory module technology, EDI now offers the widest offering of high density SRAM Modules with superior performance characteristics in cost effective plastic/FR-4 packaging.

High speed memories organized x16 and x32 are ideal for cache applications in RISC and CISC based systems. Also available are modules organized x24 for traditional DSP cache requirements.

High Density SRAM Modules

Density	Org	Part Number	Description	Speeds (ns)	Max Current Consumption ICC1 mA	ICC3 mA	IDR µA	Package Leads/Styles
32M	1Mx32	EDI9F321024C	Memory Subsystem	35-55	1440	320		80/DIP
8M	256Kx32	EDI8F32256C	Cache Designs	20-55	960	10		64/ZIP, SIMM, 60/DIP
8M	1Mx8	EDI8F81024C	Bulk Memory	70-150	130	20/0.95*	400**	36/SIP
4M	128Kx32	EDI8F32128C	Cache Designs	25-45	520	80		64/SIMM,ZIP
4M	256Kx16	EDI8F16256C	Config. x4, x8, or x16	25-70	500	10		48/DIP
4M	256Kx16	EDI8F16257C	Cache Designs	25-55	480	10		40/DIP,SIP
4M	512Kx8	EDI8F8512C	Bulk Memory	70-150	130	5/0.4*	185**	36/SIP,32/DIP
4M	512Kx8	EDI8F8513C	Bulk Memory	45-70	550	80		36/SIP
2M	64Kx32	EDI8F3264C	Cache Designs	20-55	1200	80		64/ZIP,60/DIP
2M	64Kx32	EDI8F3265C	Cache Designs with O/E	20-55	980	160		64/SIMM,ZIP
2M	256Kx8	EDI8F8257C	Surface Mount Module	70-150	130	5/0.4*	185**	32/SOIC
2M	256Kx8	EDI8F8259C	Bulk Memory	25-55	250	5		32/DIP
1M	64Kx24	EDI8F2465C	DSP Designs	20-55	750	120		64/SIMM
1M	32Kx32	EDI8F3232C	Cache Designs	25-45	440	80		64/SIMM,ZIP
1M	64Kx16	EDI8F1665C	DSP Designs	20-55	500	85		64/SIMM

**P and LP Versions, eg. EDI8F8257P or EDI8F8257LP; **LP Version only, eg. EDI8F8257LP*

Introducing
High Speed Secondary Cache Memory Arrays

In addition to standard CMOS SRAM modules, EDI is designing Second-Level Cache Module Array solutions for R3000/R4000 RISC µProcessors which integrate Address Buffers and decoupling capacitors on 50/80Ω matched impedance board technology for those 50/60MHz systems.

Cache SRAM Modules

Density	Org	Part Number	Description	Speeds (ns)	Max Current ICC1 mA	ICC3 mA	Package Leads/Styles
45M	256Kx176	EDI8F176256C	R4000 Cache Subsystem	20-35	8250	750	300/QUIP
11M	128Kx88	EDI8F88128C	High Density Cache	20-35	TBD	TBD	140/QUIP
11M	256Kx44	EDI8F44256C	High Density Cache	20-35	TBD	TBD	92/ZIP
3M	32Kx88	EDI8F8832C	High Density Cache	15-35	TBD	TBD	140/QUIP
3M	64Kx44	EDI8F4464C	High Density Cache	15-35	TBD	TBD	92/ZIP

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Military Monolithic Static RAMs

Electronic Designs Inc. offers the widest range of high speed, low power 64K, 256K and Megabit density Static RAMs in the widest variety of Package styles for Military Applications, all compliant to MIL-STD-883, paragraph 1.2.1.

Military Monolithic Dynamic RAMs

Electronic Designs Inc. provides the highest speed One Megabit density Dynamic RAMs available today for Military Applications, all compliant to MIL-STD-883, paragraph 1.2.1.

Military Static RAM Modules

Electronic Designs Inc. designs and manufactures memory modules incorporating memory ICs which are compliant to MIL-STD-883, Paragraph 1.2.1, to provide the highest performance high density Static RAMs for the most demanding military system requirements.

EDI is listed on the following DESC-Standardized Military Drawings

Density	Org.	DESC SMD-No.	
64K	8Kx8	5962-38294	
		5962-85525	
72K	8Kx9	5962-89883	
256K	32Kx8	5962-88662	
		5962-88552	Low Power
	64Kx4	5962-88681	
		5962-88545	Low Power
	256Kx1	5962-88725	
		5962-88544	Low Power
1 M	128Kx8	5962-89598	
1 M	64Kx16	5962-90858*	

For information on specific device speeds, package styles and availability contact your local EDI Sales Representative.

**Listing Pending at press time.*

Military Monolithic Static RAMs

Density	Org	Part Number	Description	Speeds (ns)	Max Current Consumption ICC1 mA	ICC3 mA	IDR µA
1M	64Kx16	EDI81664C	Standard Power	70-85			
1 M	128Kx8	EDI88128C	Single Chip Enable	70-100	95	5	
1 M	128Kx8	EDI88128LP	w/ Low Power and Data Retention	70-100	95	1	400
1 M	128Kx8	EDI88128P	Single Chip Enable Low Power	70-100	95	1	
1 M	128Kx8	EDI88130C	Dual Chip Enable	85-100	95	5	
1 M	128Kx8	EDI88130LP	w/ Low Power with Data Retention	85-100	95	1	400
1 M	128Kx8	EDI88130P	Dual Chip Enable, Low Power	85-100	95	1	
1 M	128Kx8	EDI88128CS	Single Chip Enable	25-55	180	5	
1 M	128Kx8	EDI88128LPS	w/ Low Power with Data Retention	25-55	180	2	750
1 M	128Kx8	EDI88128PS	Single Chip Enable Low Power	25-55	180	2	
1 M	128Kx8	EDI88130CSA	Dual Chip Enable	25-55	150	10	
1 M	128Kx8	EDI88130LPSA	w/ Low Power with Data Retention	25-55	150	2	750
1 M	128Kx8	EDI88130PSA	Dual Chip Enable, Low Power	25-55	150	2	
1 M	256Kx4	EDI84256CS	Common I/O	25-55	180	5	
1 M	256Kx4	EDI84256LPS	Low Power with Data Retention	25-55	180	2	750
1 M	256Kx4	EDI84256PS	Low Power	25-55	180	2	
1 M	256Kx4	EDI84258CSA	Separate I/O	25-55	150	10	
1 M	256Kx4	EDI84258LPSA	w/ Low Power with Data Retention	25-55	150	2	750
1 M	256Kx4	EDI84258PSA	Separate I/O Low Power	25-55	150	2	
1 M	1Mx1	EDI811024CSA	Standard	25-35	150	10	
1 M	1Mx1	EDI811024LPSA	Low Power with Data Retention	25-35	150	2	750
1 M	1Mx1	EDI811024PSA	Low Power	25-35	150	2	

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Military Monolithic Static RAMs

Density	Org	Part Number	Description	Speeds (ns)	Max Current Consumption ICC1 mA	ICC3 mA	IDR µA
256K	32Kx8	EDI8832C	Low Power, Data Retantion Avail.	70-150	80	0.85/0.4*	150**
256K	32Kx8	EDI8833C	Low Power, Data Retantion Avail.	35-55	125	3/0.9*	350**
256K	32Kx8	EDI8834C	Low Power, Data Retantion Avail.	35-55	165	7.50	
256K	32Kx8	EDI8834CA	Low Power, Data Retantion Avail.	20-25	TBD	TBD	
256K	64Kx4	EDI8464C	Low Power, Data Retantion Avail.	35-55	120	5/2*	500**
256K	64Kx4	EDI8465C	Low Power, Data Retantion Avail.	35-55	120	10/3*	500**
256K	64Kx4	EDI8465CA	Low Power, Data Retantion Avail.	20-25	130	10/3*	500**
256K	256Kx1	EDI81256C	Low Power, Data Retantion Avail.	35-55	120	3/1.5*	500**
72K	8Kx9	EDI8908CA	Low Power, Data Retantion Avail.	35-70	140	1/0.6*	200**
64K	8Kx8	EDI8810L	6T CMOS, Ultra Low Power	70-150	70	0.1	75

**P& LP Versions eg. EDI8832P and EDI8832LP; *LP Version only eg. EDI8832LP*

Military Monolithic Dynamic RAMs

Density	Org	Part Number	Description	Speeds (ns)	Max Current Consumption ICC1 mA	ICC3 mA	ICC4/5 µA
1 M	256Kx4	EDI44256C	Page Mode	70-150	80-55	80-55	70-35
1 M	1Mx1	EDI411024C	Page Mode	70-150	80-55	80-55	70-35
1 M	1Mx1	EDI411025C	Nibble Mode	70-100	80-60	80-60	70-50

Military Static RAM Modules

Density	Org	Part Number	Description	Speeds (ns)	Max Current Consumption ICC1 mA	ICC3 mA	IDR µA
8M	256Kx32	EDI8M32256C	For use with 32bit wide µP	35-55	1200	160	
4 M	256Kx16	EDI8M16256C	Programmable as x4, x8 or x16	25-70	2000-800	160	
4 M	256Kx16	EDI8M16257C	Upgrade from EDI8M1664C	35-55	TBD	TBD	TBD
4 M	512Kx 8	EDI8M8512C	Upgrade from EDI8M8256C	35-150	210	10	
4 M	512Kx 8	EDI8M8512LP	Low Power with Data Retention	85-150	110	5	1100
2 M	64Kx32	EDI8M3264C	For Use with 32bit wide µP	35-55	1180	140	
2 M	256Kx 8	EDI8M8256C	JEDEC Pinout	80-150	130	10	
2 M	256Kx 8	EDI8M8257C	High Speed, JEDEC Pinout	35-150	210	20	
2 M	256Kx 8	EDI8M8257LP	Low Power, JEDEC Pinout	85-150	110	5	1100
1 M	64Kx16	EDI8M1664C	JEDEC Pinout	45-100	280	25	
1 M	64Kx16	EDI8M1664LP	Low Power, JEDEC Pinout	85-100	195	15	2500
1 M	64Kx16	EDI8M1665C	High Speed	35-70	TBD	TBD	TBD
1 M	128Kx 8	EDI8M8128C	JEDEC Pinout	45-150	210	20/0.9†	500†
1 M	1Mx 1	EDI8M11024C	JEDEC Pinout	35-70	210	30	
512K	64Kx 8	EDI8M864C	JEDEC Pinout	45-150	160	20	750

†LP Version, Speeds 80-150ns only.

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November 1990
Edition 1.0

FUJITSU

DATA SHEET

MB81C4256A-60/-70/-80/-10 Series
256K x 4 Bit CMOS Fast Page Dynamic RAM

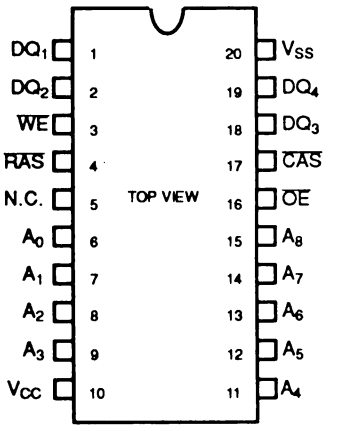
DESCRIPTION

The Fujitsu MB81C4256A is a CMOS fully decoded dynamic RAM organized as 1,048,576 words x 1 bit. The MB81C4256A has been designed for mainframe memories, buffer memories, and video image memories requiring high speed and high-bandwidth output with low power dissipation.

CMOS peripheral circuits provide low power dissipation and high speed operation.

Fujitsu's advanced three-dimensional stacked capacitor cell technology gives the MB81C4256A a high α-ray soft error immunity and long refresh time.

Pin Assignment



20-Pin DIP

This device contains circuitry to protect the inputs against damage due to high static voltages or electric fields. However, it is advised that normal precautions be taken to avoid application of any voltage higher than maximum rated voltages to this high impedance circuit.

FEATURES

- Fast Page Mode
- Read, Write, Read-write
- $\overline{RAS}$-only, hidden refresh
- $\overline{CAS}$-before-$\overline{RAS}$ refresh
- P-sub N-well CMOS
- Stacked capacitor cell
- Low input capacitance
- JEDEC approved pinout

PRODUCT SPECIFICATIONS

Parameter	Symbol	Value	Unit
Organization		262144W X 4bit	
Access Time	T_{RAC} T_{CAC} T_{AA}	60/70/80/100 15/20/20/25 30/35/40/50	ns ns ns
Cycle Time	T_{RC} T_{PC}	130/140/155/180 45/50/55/65	ns ns
Power Dissipation (Active)		407/374/341/297	mW (Max.)
Power Dissipation (TTL/CMOS Level) (Standby)		11/5.5	mW
Refresh		8.2 512	ms cycle

AVAILABLE PACKAGES

- 20 Pin 300-mil DIP (P)
- 26 Pin 300-mil SOJ (PJ)
- 20 Pin 400-mil ZIP (PZ)
- 24 Pin (236 x 567 x 47 mil) TSOP Type I, normal orientation package PFTR
- 24 Pin (236 x 567 x 47 mil) TSOP Type I, reverse orientation package PFTR

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DATA SHEET

MB81C1000A-60/-70/-80/-10 Series
1M X 1 Bit CMOS Fast Page Dynamic RAM

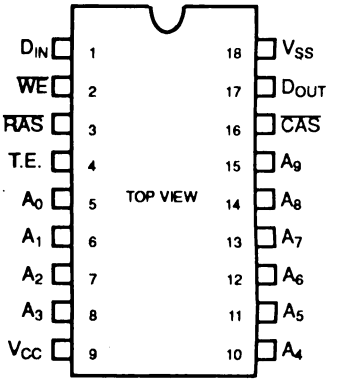
DESCRIPTION

The Fujitsu MB81C1000A is a CMOS fully decoded fast page dynamic RAM organized as 1,048,576 words x 1 bit. The MB81C1000A has been designed for mainframe memories, buffer memories, and video image memories requiring high speed with low power dissipation.

CMOS peripheral circuits provide low power dissipation and high speed operation.

Fujitsu's advanced three-dimensional stacked capacitor cell technology gives the MB81C1000A a high α-ray soft error immunity and long refresh time.

Pin Assignment



18-Pin DIP

This device contains circuitry to protect the inputs against damage due to high static voltages or electric fields. However, it is advised that normal precautions be taken to avoid application of any voltage higher than maximum rated voltages to this high impedance circuit.

FEATURES

- Fast Page Mode
- Read, Write, Read-write
- $\overline{RAS}$-only, hidden refresh
- $\overline{CAS}$-before-$\overline{RAS}$ refresh
- P-sub N-well CMOS
- Stacked capacitor cell (On-chip X4 test function)
- Low input capacitance
- JEDEC approved pinout

PRODUCT SPECIFICATIONS

Parameter	Symbol	Value	Unit
Organization		1048576W X 1bit	
Access Time	T_{RAC} T_{CAC} T_{AA}	60/70/80/100 15/20/20/25 30/35/40/50	ns ns ns
Cycle Time	T_{RC}	130/140/155/180	ns
Power Dissipation (Active)		407/374/341/297	mW (Max.)
Power Dissipation (Standby) (TTL/CMOS Level)		11/5.5	mW
Refresh		8.2 512	ms cycle

AVAILABLE PACKAGES

- 18 Pin 300-mil DIP, (P)
- 26 Pin 300-mil SOJ, (PJ)
- 20 Pin 400-mil ZIP, (PZ)
- 24 Pin (236 x 567 x 47 mil) TSOP Type I, normal orientation package (PFTN)
- 24 Pin (236 x 567 x 47 mil) TSOP Type I, reverse orientation package (RFTN)

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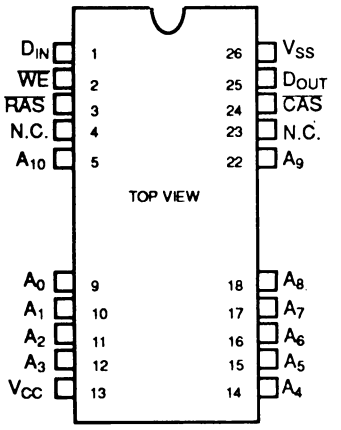
DATA SHEET

MB814100A-60/-70/-80 Series
4M x 1 Bit CMOS Fast Page Dynamic RAM

DESCRIPTION

The Fujitsu MB814100A is a fully decoded CMOS Dynamic RAM (DRAM) that contains a total of 4,194,304 memory cells in a x1 configuration. The MB814100A features a fast page mode of operation, in which high speed random access of up to 2,048 bits of data within the same row can be selected. The MB814100A DRAM is ideally suited for mainframes, buffers, hand-held computers, video imaging equipment, and other memory applications where low power dissipation is a basic requirement for the design.

Pin Assignment



26/20-Pin SOJ

This device contains circuitry to protect the inputs against damage due to high static voltages or electric fields. However, it is advised that normal precautions be taken to avoid application of any voltage higher than maximum rated voltages to this high impedance circuit.

FEATURES

- Fast Page Mode
- Read, Write, Read-write
- $\overline{RAS}$-only, hidden refresh
- $\overline{CAS}$-before-$\overline{RAS}$ refresh
- P-sub N-well CMOS
- Stacked capacitor cell (On-chip X8 test function)
- Low input capacitance

PRODUCT SPECIFICATIONS

Parameter	Symbol	Value	Unit
Organization		4194304W x 1bit	
Access Time	T_{RAC} T_{CAC} T_{AA}	60/70/80 20/20/20 30/35/40	ns ns ns
Cycle Time	T_{RC} T_{PC}	120/140/155 40/45/50	ns ns
Power Dissipation (Active)		495/424/383	mW (Max.)
Power Dissipation (Standby) (TTL/CMOS Level)		11/5.5	mW
Refresh		16.4 1024	ms cycle

AVAILABLE PACKAGES

- 26/20 Pin 300-mil SOJ (PJN)
- 20 Pin 400-mil ZIP (PZ)
- * 26/20 Pin 300-mil TSOP Type II, normal orientation package (PFTN)
- * 26/20 Pin 300-mil TSOP Type II, reverse orientation package (PFTR)

* Coming Soon

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Edition 1.0

FUJITSU

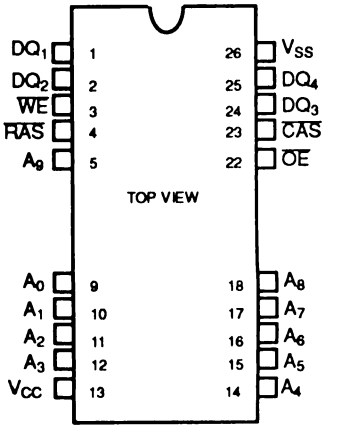
DATA SHEET

MB814400A-60/-70/-80 Series
1M x 4 Bit CMOS Fast Page Mode Dynamic RAM

DESCRIPTION

The Fujitsu MB814400A is a fully decoded CMOS Dynamic RAM (DRAM) that contains 4,194,304 memory cells accessible in 4-bit increments. The MB814400A features a fast page mode of operation in which high-speed random access of up to 1,048 bits of data within the same row can be selected. The MB814400A DRAM is ideally suited for mainframes, buffers, hand-held computers, video imaging equipment, and other memory applications where low power dissipation and high bandwidth are basic requirements of the design.

Pin Assignment



26/20-Pin SOJ

FEATURES

- Fast Page Mode
- Read, Write, Read-write
- $\overline{RAS}$-only, hidden refresh
- $\overline{CAS}$-before-$\overline{RAS}$ refresh
- P-sub N-well CMOS
- Stacked capacitor cell (On-chip X8 test function)
- Low input capacitance
- JEDEC approved pinout

This device contains circuitry to protect the inputs against damage due to high static voltages or electric fields. However, it is advised that normal precautions be taken to avoid application of any voltage higher than maximum rated voltages to this high impedance circuit.

PRODUCT SPECIFICATIONS

Parameter	Symbol	Value	Unit
Organization		1048576W x 4bit	
Access Time	T_{RAC} T_{CAC} T_{AA}	60/70/80 20/20/20 30/35/40	ns ns ns
Cycle Time	T_{RC} T_{PC}	120/140/155 40/45/50	ns ns
Power Dissipation (Active)		495/424/383	mW (Max.)
Power Dissipation (Standby) (TTL/CMOS Level)		11/5.5	mW
Refresh		16.4 1024	ms cycle

AVAILABLE PACKAGES

- 26/20 Pin 300-mil SOJ (PJ)
- 20 Pin 400-mil ZIP (PZ)
- 20/26 Pin 300-mil TSOP Type II, normal orientation package (PFTN)
- 20/26 Pin 300-mil TSOP Type II, reverse orientation package (PFTR)

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Fujitsu Microelectronics

October 1991

FUJITSU

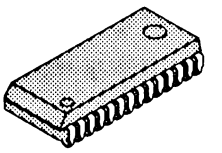
DATA SHEET

MB8116100-60/-70/-80
CMOS 16M x 1 Bit Fast Page Mode Dynamic RAM

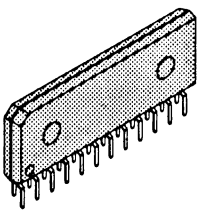
The Fujitsu MB8116100 is a fully decoded CMOS Dynamic RAM (DRAM) that contains a total of 16,777,216 memory cells in a x1 configuration. The MB8116100 features a fast page mode of operation whereby high-speed random access of up to 4,096 bits of data within the same row can be selected. The MB8116100 DRAM is ideally suited for mainframe memories, buffer memories, video imaging equipment, and other memory applications where low power dissipation, high bandwidth, and compact layout are basic requirements of the design.

The MB8116100 is fabricated using silicon gate CMOS and Fujitsu's advanced four-layer polysilicon and two layer aluminum process. This process, coupled with advanced stacked capacitor memory cells, reduces the possibility of soft errors and extends the time interval between memory refreshes. Clock timing requirements for the MB8116100 are not critical and all inputs are TTL compatible.

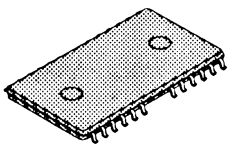
ADVANCE INFORMATION



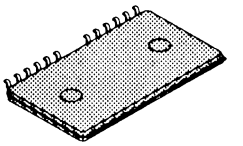
24-/28-Pin SOJ



24-Pin ZIP



28-Pin TSOP
(Normal Bend Leads)



28-Pin TSOP
(Reverse Bend Leads)

Features

Parameter	MB8116100-60	MB8116100-70	MB8116100-80
$\overline{RAS}$ Access Time	60 ns max.	70 ns max.	80 ns max.
Random Cycle Time	110 ns min.	130 ns min.	150 ns min.
Address Access Time	30 ns max.	35 ns max.	40 ns max.
$\overline{CAS}$ Access Time	15 ns max.	17 ns max.	20 ns max.
Fast Page Mode Cycle Time	40 ns min.	45 ns min.	50 ns min.
Low Power Dissipation • Operating Current	550 mW max.	495 mW max.	440 mW max.
• Standby Current	11 mW max. (TTL level)/5.5 mW max. (CMOS level)		

- 16,777,216 words x 1 bit organization
- Silicon gate, CMOS Advanced Stacked Capacitor Cell
- All inputs and outputs are TTL compatible
- 4,096 refresh cycles every 65.6 ms
- Common I/O capability by using early write
- $\overline{RAS}$ only, $\overline{CAS}$-before-$\overline{RAS}$, or Hidden Refresh
- Fast page mode, Read-Modify-Write capability
- On-chip substrate bias generator for high performance

Absolute Maximum Ratings (See Note)

Parameter	Symbol	Ratings	Unit
Voltage at any pin relative to V_{SS}	V_{IN}, V_{OUT}	−1 to +7	V
Voltage of V_{CC} supply relative to V_{SS}	V_{CC}	−1 to +7	V
Power dissipation	PD	1.0	W
Short circuit output current	—	50	mA
Storage temperature	T_{STG}	−55 to +125	°C

Note: Permanent device damage may occur if absolute maximum ratings are exceeded. Functional operation should be restricted to the conditions as detailed in the operation sections of this data sheet. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

This device contains circuitry to protect the inputs against damage due to high static voltages or electric fields. However, it is advised that normal precautions be taken to avoid application of any voltage higher than maximum rated voltages to this high impedance circuit.

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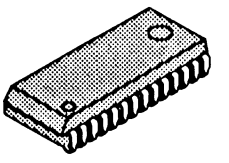
DATA SHEET

MB8116101-60/-70/-80
CMOS 16M x 1 Bit Nibble Mode Dynamic RAM

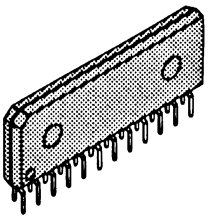
ADVANCE INFORMATION

The Fujitsu MB8116101 is a fully decoded CMOS Dynamic RAM (DRAM) that contains a total of 16,777,216 memory cells in a x1 configuration. The MB8116101 features a nibble mode of operation which enables high-speed serial access of up to four bits of data. The MB8116101 DRAM is ideally suited for mainframe memories, buffer memories, video imaging equipment, and other memory applications where low power dissipation, high bandwidth, and compact layout are basic requirements of the design.

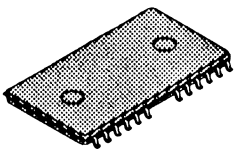
The MB8116101 is fabricated using silicon gate CMOS and Fujitsu's advanced four-layer polysilicon and two layer aluminum process. This process, coupled with advanced stacked capacitor memory cells, reduces the possibility of soft errors and extends the time interval between memory refreshes. Clock timing requirements for the MB8116101 are not critical and all inputs are TTL compatible.



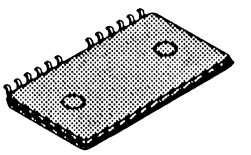
24-/28-Pin SOJ



24-Pin ZIP



28-Pin TSOP
(Normal Bend Leads)



28-Pin TSOP
(Reverse Bend Leads)

Features

Parameter	MB8116101-60	MB8116101-70	MB8116101-80
$\overline{RAS}$ Access Time	60 ns max.	70 ns max.	80 ns max.
Random Cycle Time	110 ns min.	130 ns min.	150 ns min.
Address Access Time	30 ns max.	35 ns max.	40 ns max.
$\overline{CAS}$ Access Time	15 ns max.	17 ns max.	20 ns max.
Nibble Mode Cycle Time	35 ns min.	37 ns min.	40 ns min.
Low Power Dissipation • Operating Current	550 mW max.	495 mW max	440 mW max.
• Standby Current	11 mW max. (TTL level)/5.5 mW max. (CMOS level)		

- 16,777,216 words x 1 bit organization
- Silicon gate, CMOS Advanced Stacked Capacitor Cell
- All inputs and outputs are TTL compatible
- 4,096 refresh cycles every 65.6 ms
- Common I/O capability by using early write
- $\overline{RAS}$ only, $\overline{CAS}$-before-$\overline{RAS}$, or Hidden Refresh
- Nibble Mode, Read-Modify-Write capability
- On-chip substrate bias generator for high performance

Absolute Maximum Ratings (See Note)

Parameter	Symbol	Ratings	Unit
Voltage at any pin relative to V_{SS}	V_{IN}, V_{OUT}	−1 to +7	V
Voltage of V_{CC} supply relative to V_{SS}	V_{CC}	−1 to +7	V
Power dissipation	PD	1.0	W
Short circuit output current	—	50	mA
Storage temperature	T_{STG}	−55 to +125	°C

Note: Permanent device damage may occur if absolute maximum ratings are exceeded. Functional operation should be restricted to the conditions as detailed in the operation sections of this data sheet. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

This device contains circuitry to protect the inputs against damage due to high static voltages or electric fields. However, it is advised that normal precautions be taken to avoid application of any voltage higher than maximum rated voltages to this high impedance circuit.

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October 1991

DATA SHEET

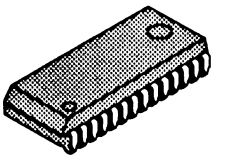
FUJITSU

MB8116400-60/-70/-80
CMOS 4M x 4 Bit Fast Page Mode Dynamic RAM

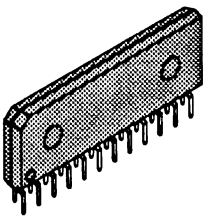
The Fujitsu MB8116400 is a fully decoded CMOS Dynamic RAM (DRAM) that contains a total of 16,777,216 memory cells accessible in 4-bit increments. The MB8116400 features a fast page mode of operation which enables high-speed random access of up to 1,024 bits of data. The MB8116400 DRAM is ideally suited for mainframes, hand-held computers, video imaging equipment, and other memory applications where low power dissipation and high bandwidth are basic requirements of the design.

The MB8116400 is fabricated using silicon gate CMOS and Fujitsu's advanced four-layer polysilicon and two-layer aluminum process. This process, coupled with advanced stacked capacitor memory cells, reduces the possibility of soft errors and extends the time interval between memory refreshes. Clock timing requirements for the MB8116400 are not critical and all inputs are TTL compatible.

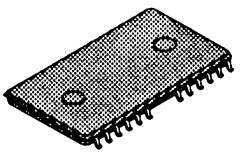
ADVANCE INFORMATION



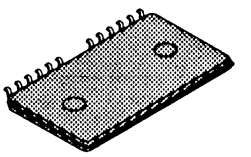
24-/28-Pin SOJ



24-Pin ZIP



28-Pin TSOP
(Normal Bend Leads)



28-Pin TSOP
(Reverse Bend Leads)

Features

Parameter	MB8116400-60	MB8116400-70	MB8116400-80
$\overline{RAS}$ Access Time	60 ns max.	70 ns max.	80 ns max.
Random Cycle Time	110 ns min.	130 ns min.	150 ns min.
Address Access Time	30 ns max.	35 ns max.	40 ns max.
$\overline{CAS}$ Access Time	15 ns max.	17 ns max.	20 ns max.
Fast Page Mode Cycle Time	40 ns min.	45 ns min.	50 ns min.
Low Power Dissipation • Operating Current	550 mW max.	495 mW max.	440 mW max.
• Standby Current	11 mW max. (TTL level)/5.5 mW max. (CMOS level)		

- 4,194,304 words x 4 bit organization
- Silicon gate, CMOS Advanced Stacked Capacitor Cell
- All inputs and outputs are TTL compatible
- 4,096 refresh cycles every 65.6 ms
- Early write or $\overline{OE}$ controlled write capability
- $\overline{RAS}$ only, $\overline{CAS}$-before-$\overline{RAS}$, or Hidden Refresh
- Fast page mode, Read-Modify-Write capability
- On-chip substrate bias generator for high performance

Absolute Maximum Ratings (See Note)

Parameter	Symbol	Ratings	Unit
Voltage at any pin relative to V_{SS}	V_{IN}, V_{OUT}	−1 to +7	V
Voltage of V_{CC} supply relative to V_{SS}	V_{CC}	−1 to +7	V
Power dissipation	PD	1.0	W
Short circuit output current	—	50	mA
Storage temperature	T_{STG}	−55 to +125	°C

Note: Permanent device damage may occur if absolute maximum ratings are exceeded. Functional operation should be restricted to the conditions as detailed in the operation sections of this data sheet. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

This device contains circuitry to protect the inputs against damage due to high static voltages or electric fields. However, it is advised that normal precautions be taken to avoid application of any voltage higher than maximum rated voltages to this high impedance circuit.

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February 1990
Edition 1.0

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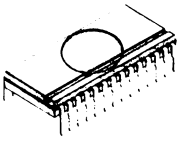
DATA SHEET

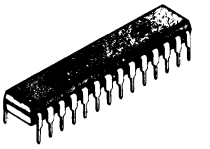
MB84256A-70/70L/70LL/-10/10L/10LL/-12/12L/12LL/-15/15L/15LL
CMOS 256K-BIT LOW POWER SRAM

32,768 WORD x 8-BIT CMOS STATIC RANDOM ACCESS MEMORY WITH DATA RETENTION

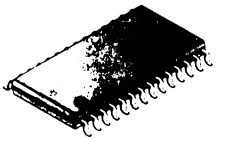
PRELIMINARY



PLASTIC PACKAGE
DIP-28P-M02



PLASTIC PACKAGE
DIP-28P-M04



PLASTIC PACKAGE
FPT-28P-M02

The Fujitsu MB84256A is a 32,768–word by 8–bit static random access memory fabricated with a CMOS silicon gate process. The memory utilizes asynchronouse circuitry and may be maintained in any state for an indefinite period of time. All pins are TTL compatible, and a single +5V power supply is required.

The MB84256A is ideally suited for use in microprocesser systems and other applications where fast access time and ease of use are required. All devices offer the advantages of low power dissipation, low cost and high performance.

- Organization: 32,768 x 8 bits
- Fast access time: 70 ns max. (MB84256A-70/70L/70LL)
  100 ns max. (MB84256A-10/10L/10LL)
  120 ns max. (MB84256A-12/12L/12LL)
  150 ns max. (MB84256A-15/15L/15LL)
- Completely static operation: No clock required
- TTL compatible inputs/outputs
- Three state outputs
- Single +5V power supply,±10% tolerance
- Low power standby:

  CMOS level: 5.5 mW max. (MB84256A-70/10/12/15)
  0.55 mW max. (MB84256A-70L/70LL/10L/10LL/12L/12LL/15L/15LL)

  TTL level: 16.5 mW max. (MB84256A-70/70L/70LL/10/10L/10LL/12/12L/12LL/15/15L/15LL)
- Data retention: 2.0V min.
- Standard 28–pin (600mil) (Suffix: P)
- Standard 28–pin (300mil) (Suffix: P-SK)
- Standard 28-pin Bend-type FPT (450mil) (Suffix: PF)
- Standard 28-pin Bend-type TSOP (Suffix: PFT)

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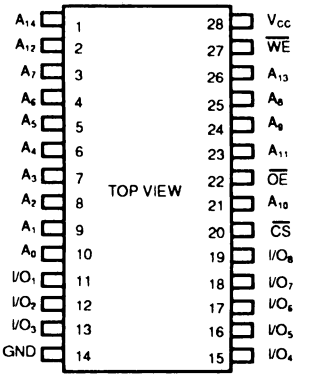
PIN ASSIGNMENT



ABSOLUTE MAXIMUM RATINGS (see NOTE)

Rating	Symbol	Value	Unit
Supply Voltage	V_{CC}	–0.5 to +7.0	V
Input Voltage	V_{IN}	–0.5 to V_{CC} +0.5	V
Output Voltage	$V_{I/O}$	–0.5 to V_{CC} +0.5	V
Temperature Under Bias	T_{BIAS}	–10 to +85	°C
Storage Temperature	T_{STG}	–40 to +125	°C

NOTE: Permanent device damage may occur if the above **Absolute Maximum Ratings** are exceeded. Functional operation should be restricted to the conditions as detailed in the operational sections of this data sheet. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

This device contains circuitry to protect the inputs against damage due to high static voltages or electric fields. However, it is advised that normal precautions be taken to avoid application of any voltage higher than maximum rated voltages to this high impedance circuit.

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FUJITSU

DATA SHEET

MB82B001-25/-35
1M BIT HIGH SPEED BI-CMOS SRAM

1,048,576 WORDS x 1 BIT HIGH SPEED BI–CMOS STATIC RANDOM ACCESS MEMORY

PRELIMINARY

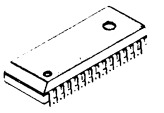
The Fujitsu MB82B001 is 1,048,576 words x 1 bit static random access memory fabricated with a Bi–CMOS process technology. To make power dissipation lower and high speed, peripheral circuits consist of Bi–CMOS technology, and to obtain smaller chip size, cells consist of NMOS transistors and resistors.

The memory utilizes asynchronous circuitry and may be maintained in any state for an indefinite period of time. All pins are TTL compatible, and a single 5 volts power supply is required. The MB82B001 has 400mil plastic small out–line J–lead(SOJ) as package option.

The MB82B001 is ideally suited for use in dataprocessing systems and other applications where fast access time and ease of use are required. All devices offer the advantages of low power dissipation, low cost and high peformance.

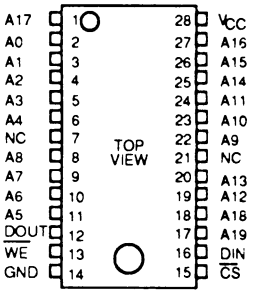
- Organization: 1,048,576 words x 1 bit
- Static operation: No clocks or refresh required
- Fast access time: 25ns max. (MB82B001–25)
  35ns max. (MB82B001–35)
- Single +5V(±10%) power supply with low current drain

  Active operation = 120mA max.
  Standby operation = 15mA max. (CMOS level)
  Standby operation = 25mA max. (TTL level)
- Separate data input and output
- TTL compatible inputs and output
- Chip select for simplified memory expansion, automatic power down
- All inputs and output have protection against static charge
- 400 mil width 28–pin SOJ package (Suffix: –PJ)



PLASTIC PACKAGE
LCC–28P–M05

PIN ASSIGNMENT



ABSOLUTE MAXIMUM RATINGS (see NOTE)

Rating	Symbol	Value	Unit
Supply Voltage	V_{CC}	–0.5 to +7.0	V
Input Voltage on any pin with to GND	V_{IN}	–0.5 to +7.0	V
Output Voltage on any pin with to GND	V_{OUT}	–0.5 to +7.0	V
Power Dissipation	P_D	1.0	W
Output Current	I_{OUT}	±20	mA
Temperature under Bias	T_{BIAS}	–10 to +85	°C
Storage Temperature	T_{STG}	–40 to +125	°C

NOTE: Permanent device damage may occur if the above **Absolute Maximum Ratings** are exceeded. Functional operation should be restricted to the conditions as detailed in the operational sections of this data sheet. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

This device contains circuitry to protect the inputs against damage due to high static voltages or electric fields. However, it is advised that normal precautions be taken to avoid application of any voltage higher than maximum rated voltages to this high impedance circuit.

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FUJITSU

DATA SHEET

MB82B005-25/-35
1M BIT HIGH SPEED BI-CMOS SRAM

262,144 WORDS x 4 BITS HIGH SPEED BI–CMOS STATIC RANDOM ACCESS MEMORY

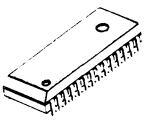
PRELIMINARY

The Fujitsu MB82B005 is 262,144 words x 4 bits static random access memory fabricated with a Bi–CMOS process technology. To make power dissipation lower and high speed, peripheral circuits consist of Bi–CMOS technology, and to obtain smaller chip size, cells consist of NMOS transistors and resistors.

The memory utilizes asynchronous circuitry and may be maintained in any state for an indefinite period of time. All pins are TTL compatible, and a single 5 volts power supply is required. The MB82B005 has 400mil plastic small out–line J–lead(SOJ) as package option.

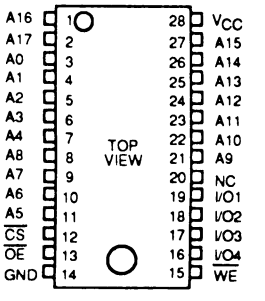
The MB82B005 is ideally suited for use in dataprocessing systems and other applications where fast access time and ease of use are required. All devices offer the advantages of low power dissipation, low cost and high peformance.

- Organization: 262,144 words x 4 bits
- Static operation: No clocks or refresh required
- Fast access time: 25ns max. (MB82B005–25)
  35ns max. (MB82B005–35)
- Single +5V(±10%) power supply with low current drain
  Active operation = 120mA max.
  Standby operation = 15mA max. (CMOS level)
  Standby operation = 25mA max. (TTL level)
- Common data input and output
- TTL compatible inputs and outputs
- Chip select for simplified memory expansion, automatic power down
- All inputs and output have protection against static charge
- 400 mil width 28–pin SOJ package (Suffix: –PJ)



PLASTIC PACKAGE
LCC–28P–M05

PIN ASSIGNMENT



ABSOLUTE MAXIMUM RATINGS (see NOTE)

Rating	Symbol	Value	Unit
Supply Voltage	V_{CC}	–0.5 to +7.0	V
Input Voltage on any pin with to GND	V_{IN}	–0.5 to +7.0	V
Output Voltage on any pin with to GND	V_{OUT}	–0.5 to +7.0	V
Power Dissipation	P_D	1.0	W
Output Current	I_{OUT}	±20	mA
Temperature under Bias	T_{BIAS}	–10 to +85	°C
Storage Temperature	T_{STG}	–40 to +125	°C

NOTE: Permanent device damage may occur if the above **Absolute Maximum Ratings** are exceeded. Functional operation should be restricted to the conditions as detailed in the operational sections of this data sheet. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

This device contains circuitry to protect the inputs against damage due to high static voltages or electric fields. However, it is advised that normal precautions be taken to avoid application of any voltage higher than maximum rated voltages to this high impedance circuit.

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September 1990
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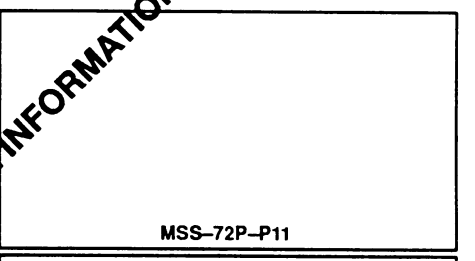
DATA SHEET

MB85336-60/-70/-80/-10
CMOS 256K x 36 Fast Page Mode DRAM Module

ADVANCE INFORMATION

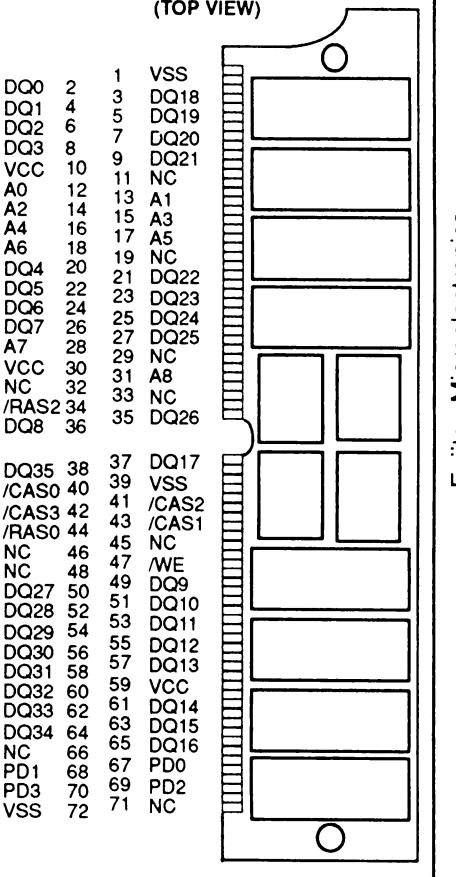
The Fujitsu MB85336 is a fully decoded, CMOS dynamic random access memory (DRAM) module consisting of eight MB81C4256A devices and four MB81C256A devices. The MB85336 is optimized for those applications requiring high speed, high performance and large memory storage. The operation and electrical characteristics of the MB85336 are the same as the MB81C4256A which features fast page mode operation. For ease of memory expansion, the MB85336 is offered in a 72-pad Single In-Line Memory Module Package (SIMM).

- Organization:
  262,144 words x 36 bit
- $\overline{RAS}$ Access Time
  60 ns max. (MB85336-60)
  70 ns max. (MB85336-70)
  80 ns max. (MB85336-80)
  100 ns max. (MB85336-10)
- $\overline{CAS}$ Access Time:
  15 ns max. (MB85336-60)
  20 ns max. (MB85336-70)
  20 ns max. (MB85336-80)
  25 ns max. (MB85336-10)
- Column Address Access Time:
  30 ns max. (MB85336-60)
  35 ns max. (MB85336-70)
  40 ns max. (MB85336-80)
  50 ns max. (MB85336-10)
- Fast Page Mode
- Active Power:
  4884 mW max. (MB85336-60)
  4488 mW max. (MB85336-70)
  4092 mW max. (MB85336-80)
  3564 mW max. (MB85336-10)
- Standby Power:
  66 mW max. (CMOS Level)
  132 mW max. (TTL Level)
- Single +5 V Supply ±10% Tolerance
- TTL Compatible I/O
- Decoupling Capacitor:
  0.22 µF, 12 pcs
- JEDEC Standard Package Outline:
  72-pad SIMM (MB85336-XXPS)
  72-pad SIMM (MB85336-XXPSG*)
  *PSG = Gold Pad



MSS-72P-P11

PAD ASSIGNMENT
(TOP VIEW)



		1	VSS		
DQ0	2	3	DQ18		
DQ1	4	5	DQ19		
DQ2	6	7	DQ20		
DQ3	8	9	DQ21		
VCC	10	11	NC		
A0	12	13	A1		
A2	14	15	A3		
A4	16	17	A5		
A6	18	19	NC		
DQ4	20	21	DQ22		
DQ5	22	23	DQ23		
DQ6	24	25	DQ24		
DQ7	26	27	DQ25		
A7	28	29	NC		
VCC	30	31	A8		
NC	32	33	NC		
/RAS2	34	35	DQ26		
DQ8	36				
DQ35	38	37	DQ17		
/CAS0	40	39	VSS		
/CAS3	42	41	/CAS2		
/RAS0	44	43	/CAS1		
NC	46	45	NC		
NC	48	47	/WE		
DQ27	50	49	DQ9		
DQ28	52	51	DQ10		
DQ29	54	53	DQ11		
DQ30	56	55	DQ12		
DQ31	58	57	DQ13		
DQ32	60	59	VCC		
DQ33	62	61	DQ14		
DQ34	64	63	DQ15		
NC	66	65	DQ16		
PD1	68	67	PD0		
PD3	70	69	PD2		
VSS	72	71	NC		

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ABSOLUTE MAXIMUM RATINGS (See note)

Rating	Symbol	Value	Rating
Supply Voltage	V_{CC}	−1.0 to +7.0	V
Input Voltage	V_{IN}	−1.0 to +7.0	V
Output Voltage	V_{OUT}	−1.0 to +7.0	V
Short Circuit Output Current	I_{OUT}	±50	mA
Power Dissipation	P_D	10.0	W
Storage Temperature	T_{STG}	−55 to +125	°C

Note: Permanent device damage may occur if absolute maximum ratings are exceeded. Functional operation should be restricted to the conditions as detailed in the operation sections of this data sheet. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

This device contains circuitry to protect the inputs against damage due to high static voltages or electric fields. However, it is advised that normal precautions be taken to avoid application of any voltage higher than maximum rated voltage to this high impedance circuit.

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September 1990
Edition 1.0

FUJITSU

DATA SHEET

MB85346-80/-10/-12
CMOS 1M x 36 Fast Page Mode DRAM Module

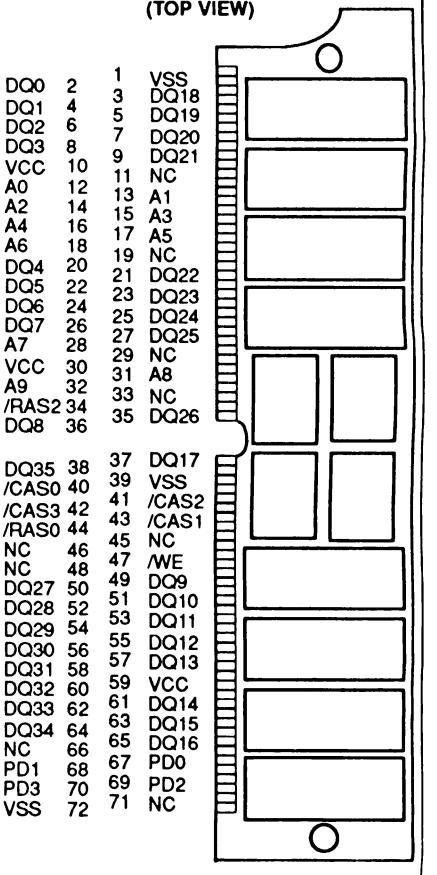
ADVANCE INFORMATION

The Fujitsu MB85346 is a fully decoded, CMOS dynamic random access memory (DRAM) module consisting of eight MB814400 devices and four MB81C1000A devices. The MB85346 is optimized for those applications requiring high speed, high performance and large memory storage. The operation and electrical characteristics of the MB85346 are the same as the MB814400 which features fast page mode operation. For ease of memory expansion, the MB85346 is offered in a 72-pad Single In-Line Memory Module Package (SIMM).

- Organization:
  1,048,576 words x 36 bits
- $\overline{RAS}$ Access Time
  80 ns max. (MB85346-80)
  100 ns max. (MB85346-10)
  120 ns max. (MB85346-12)
- $\overline{CAS}$ Access Time:
  25 ns max. (MB85346-80)
  30 ns max. (MB85346-10)
  35 ns max. (MB85346-12)
- Column Address Access Time:
  45 ns max. (MB85346-80)
  50 ns max. (MB85346-10)
  60 ns max. (MB85346-12)
- Fast Page Mode
- Active Power:
  4664 mW max. (MB85346-80)
  4048 mW max. (MB85346-10)
  3608 mW max. (MB85346-12)
- Standby Power:
  66 mW max. (CMOS Level)
  132 mW max. (TTL Level)
- Single +5 V Supply ±10% Tolerance
- TTL Compatible I/O
- Decoupling Capacitor:
  0.22 µF, 12 pcs
- JEDEC Standard Package Outline:
  72-pad SIMM (MB85346-XXPS)
  72-pad SIMM (MB85346-XXPSG*)
  *PSG = Gold Pad

MSS–72P–P11

PAD ASSIGNMENT
(TOP VIEW)



		1	VSS
DQ0	2	3	DQ18
DQ1	4	5	DQ19
DQ2	6	7	DQ20
DQ3	8	9	DQ21
VCC	10	11	NC
A0	12	13	A1
A2	14	15	A3
A4	16	17	A5
A6	18	19	NC
DQ4	20	21	DQ22
DQ5	22	23	DQ23
DQ6	24	25	DQ24
DQ7	26	27	DQ25
A7	28	29	NC
VCC	30	31	A8
A9	32	33	NC
/RAS2	34	35	DQ26
DQ8	36		
DQ35	38	37	DQ17
/CAS0	40	39	VSS
/CAS3	42	41	/CAS2
/RAS0	44	43	/CAS1
NC	46	45	NC
NC	48	47	/WE
DQ27	50	49	DQ9
DQ28	52	51	DQ10
DQ29	54	53	DQ11
DQ30	56	55	DQ12
DQ31	58	57	DQ13
DQ32	60	59	VCC
DQ33	62	61	DQ14
DQ34	64	63	DQ15
NC	66	65	DQ16
PD1	68	67	PD0
PD3	70	69	PD2
VSS	72	71	NC

This device contains circuitry to protect the inputs against damage due to high static voltages or electric fields. However, it is advised that normal precautions be taken to avoid application of any voltage higher than maximum rated voltage to this high impedance circuit.

ABSOLUTE MAXIMUM RATINGS (See note)

Rating	Symbol	Value	Rating
Supply Voltage	V_{CC}	−1.0 to +7.0	V
Input Voltage	V_{IN}	−1.0 to +7.0	V
Output Voltage	V_{OUT}	−1.0 to +7.0	V
Short Circuit Output Current	I_{OUT}	±50	mA
Power Dissipation	P_D	10.0	W
Storage Temperature	T_{STG}	−55 to +125	°C

Note: Permanent device damage may occur if absolute maximum ratings are exceeded. Functional operation should be restricted to the conditions as detailed in the operation sections of this data sheet. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

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February 1990
Edition 1.0

FUJITSU

PRODUCT INFORMATION

MB87033B Series

SCSI Protocol Controller (SPC) With On-Chip Drivers/Receivers

GENERAL DESCRIPTION

The MB87033 SCSI Protocol Controller (SPC) is a CMOS LSI circuit specifically designed to control a Small Computer Systems Interface (SCSI). The MB87033 rounds out Fujitsu's SPC family of protocol controllers by providing software enhancements and other functional features that will meet all facits of the SCSI specification (ANSI X 3.131-1986).

To achieve optimum performance and interface flexibility, the MB87033 provides an 8-byte First-In First-Out (FIFO) data buffer register and a 28-bit transfer byte counter which allows burst transfers of up to 256 megabytes. To improve programming requirements, "Attention Detect" and "Arbitration Fail" interrupts are provided and on-chip driver/receiver circuits simplify interface connections. Data transfers can be executed in either the asynchronous or synchronous mode with a maximum offset of 8-bytes.

SCSI Compatibility

- Supports all mandatory commands, many optional commands, and some extended commands of SCSI Specification (ANSI X3.131, 1986)
- Software compatible with MB87030/31
- Serves as either INITIATOR or TARGET

Data Buses

- Independent buses for CPU and DMA controller

Transfer Modes

- Asynchronous
- Synchronous mode transfers with programmable offset of up to eight bytes (8-byte FIFO)

Data Transfer Speed

- Up to a maximum of 5-megabyte/sec

Selectable Operating Modes

- DMA transfers
- Program transfers
- Manual Transfers
- Diagnostic

Interface

- On-chip single ended Drivers/Receivers
- Guaranteed to sink 48mA regardless of the number of outputs simultaneously asserted

Enhancements

- On-chip parity generation
- Attention condition detect interrupt
- Arbitration fail interrupt

Clock Requirements

- 10MHz clock

Technology/Power Requirements

- Silicon-gate CMOS
- Single +5V power supply

Available Packaging

- 84-pin plastic leadless chip carrier
- 80-pin plastic flat package

ABSOLUTE MAXIMUM RATINGS[1]

Rating	Symbol	Values		Unit
		Min	Max	
Supply Voltage	V_{DD}	V_{SS}[2] –0.3	6.0	V
Input Voltage	V_I	V_{SS}[2] –0.3	V_{DD} + 0.3	V
Output Voltage[2]	V_O	V_{SS}[2] –0.3	V_{DD} + 0.3	V
Storage Temperature (Ceramic)	T_{STG}	–65	+125	°C

NOTES:

1. Permanent device damage may occur if the above Absolute Maximum Ratings are exceeded. Functional operation should be restricted to the conditions as detailed in the operational sections of this data sheet. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.
2. V_{SS} = 0 V
3. Not more than one output may be shorted at a time for a maximum duration of one second.

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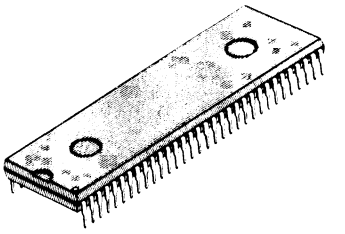
MB86140

PICTURE IN PICTURE CONTROLLER

TS717-A906
June 1990

PRELIMINARY



PLASTIC PACKAGE
DIP-64P-M01

The Fujitsu MB86140, fabricated in CMOS process technology, is a picture in picture controller for TV/VTR applications conform to NTSC mode.

The MB86140 is an exclusive controller of the picture in picture system composed of PLL IC (MB3511), dual port RAM (MB81461) and A/D·D/A converter (MB40176).

- NTSC mode
- Picture in picture function
  - Separate/Compress/Composite function of brightness signal and colour signal
  - Memory control function
  - Selectable motion picture mode (all field) or still mode picture (single field)
  - Selectable sub-picture position: Upper left, lower left, upper right, or lower right
  - AFC (Automatic frequency control) function
- Solarization mode function
- Indication signal output for PIP mode or solarization mode
- Input video signal: NTSC composite video signal (6Bit/4fsc)
- Output video signal for sub-picture: (NTSC) composite video signal (6Bit/4fsc)
- Single supply voltage: +5 V
- 64-pin plastic dual-in-line package

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ABSOLUTE MAXIMUM RATINGS (See NOTE) (VSS=0V)

Rating	Symbol	Condition		Value	Unit
Supply Voltage	VDD			VSS-0.5 to +6.0	V
Input Voltage	VI			VSS-0.5 to VDD+0.5	V
Output Voltage	VO			VSS-0.5 to VDD+0.5	V
Operating Temperature	TA			-25 to +85	°C
Storage Temperature	TSTG			-40 to +125	°C
Output Current	IO	VDD=Max.	VO=VDD	+70	mA
			VO=0V	-40	

NOTE: Permanent device damage may occur if ABSOLUTE MAXIMUM RATINGS are exceeded. Functional operation should be restricted to the conditions as detailed in the operational sections of this data sheet. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

This device contains circuitry to protect the inputs against damage due to high static voltages or electric fields. However, it is advised that normal precautions be taken to avoid application of any voltage higher than maximum rated voltages to this high impedance circuit.

When contacting suppliers, say you saw it in IC MASTER

July 1991
Edition 3.0

FUJITSU

DATA SHEET

MB98A8081-20/8091-20/8101-20/8111-20 FLASH MEMORY CARD

FLASH ERASEABLE PROGRAMMABLE MEMORY CARD 256K/512K/1M/2M-BYTE

The Fujitsu MB98A8081, MB98A8091, MB98A8101 and MB98A8111 are flash memory cards capable of storing and retrieving large amounts of data. Each flash memory card contains multiple 1M–bit flash memory devices.

The flash memory card circuits are housed in a credit-card sized 68-pin package. Internal circuitry is protected by metal plates on the top and bottom of the card to help reduce chip damage from electro-static discharge.

A unique feature of the Fujitsu memory cards allow the user to organize the card into either an 8-bit or a 16-bit organization. All cards are portable and operate at high speed with low power needs.

- Card Dimensions: 85.6 length x 54.0 width x 3.3 thickness (mm)
- Connector Type: Two-piece 68–pin (Built–in 68-pin receptacle, 2–row type)
- Command control for Write / Erase operation
- Write protect function
- + 5.0V ±5% power supply (12.0V ±5% VPP)

CRD–68P–M05

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AVAILABLE ORGANIZATIONS

Part Number	Mounted Memory Devices	Access Time	Memory Organization *1
MB98A8081–20	1M–bit flash memory x 2 pcs	200 ns	256K x 8 bits/128K x 16 bits
MB98A8091–20	1M–bit flash memory x 4 pcs	200 ns	512K x 8 bits/256K x 16 bits
MB98A8101–20	1M–bit flash memory x 8 pcs	200 ns	1 M x 8 bits/512K x 16 bits
MB98A8111–20	1M–bit flash memory x 16 pcs	200 ns	2 M x 8 bits/ 1 M x 16 bits

Note: *1 To be configured by user.

ABSOLUTE MAXIMUM RATINGS (see NOTE.)

Rating	Symbol	Value	Unit
Supply Voltage	V_{CC}	–0.5 to +6.0	V
Input Voltage	V_{IN}	–0.5 to +6.0	V
Output Voltage	V_{OUT}	–0.5 to +6.0	V
Programming Voltage *1	V_{PP1}, V_{PP2}	–2.0 to +14.0	V
Temperature under Bias	T_{BIAS}	–10 to +70	°C
Operating Temperature	T_A	0 to +60	°C
Storage Temperature	T_{STG}	–30 to +70	°C

Note:*1 Minimum DC input voltage is –0.5V.

NOTE: Permanent device damage may occur if the above **Absolute Maximum Ratings** are exceeded. Functional operation should be restricted to the conditions as detailed in the operational sections of this data sheet. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

This device contains circuitry to protect the inputs against damage due to high static voltages or electric fields. However, it is advised that normal precautions be taken to avoid application of any voltage higher than maximum rated voltages to this high impedance circuit.

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DATA SHEET

MB98A8092-20/8102-20/8112-20/8122-20 FLASH MEMORY CARD

FLASH ERASEABLE PROGRAMMABLE MEMORY CARD 512K/1M/2M/4M-BYTE

The Fujitsu MB98A8092, MB98A8102, MB98A8112 and MB98A8122 are flash memory cards capable of storing and retrieving large amounts of data. Each flash memory card contains multiple 2M-bit flash memory devices.

The flash memory card circuits are housed in a credit-card sized 68-pin package. Internal circuitry is protected by metal plates on the top and bottom of the card to help reduce chip damage from electro-static discharge.

A unique feature of the Fujitsu memory cards allow the user to organize the card into either an 8-bit or a 16-bit organization. All cards are portable and operate at high speed with low power needs.

- Card Dimensions: 85.6 length x 54.0 width x 3.3 thickness (mm)
- Connector Type: Two-piece 68-pin (Built-in 68-pin receptacle, 2-row type)
- Command control for Write / Erase operation
- Write protect function
- + 5.0V ±5% power supply (12.0V ±5% VPP)

CRD-68P-M05

Fujitsu Microelectronics

AVAILABLE ORGANIZATIONS

Part Number	Mounted Memory Devices	Access Time	Memory Organization *1
MB98A8092-20	2M-bit flash memory x 2 pcs	200 ns	512K x 8 bits/256K x 16 bits
MB98A8102-20	2M-bit flash memory x 4 pcs	200 ns	1 M x 8 bits/512K x 16 bits
MB98A8112-20	2M-bit flash memory x 8 pcs	200 ns	2 M x 8 bits/ 1 M x 16 bits
MB98A8122-20	2M-bit flash memory x 16 pcs	200 ns	4 M x 8 bits/ 2 M x 16 bits

Note: *1 To be configured by user.

ABSOLUTE MAXIMUM RATINGS (see NOTE.)

Rating	Symbol	Value	Unit
Supply Voltage	V_{CC}	−0.5 to +6.0	V
Input Voltage	V_{IN}	−0.5 to +6.0	V
Output Voltage	V_{OUT}	−0.5 to +6.0	V
Programming Voltage *1	V_{PP1}, V_{PP2}	−2.0 to +14.0	V
Temperature under Bias	T_{BIAS}	−10 to +70	°C
Operating Temperature	T_A	0 to +60	°C
Storage Temperature	T_{STG}	−30 to +70	°C

Note: *1 Minimum DC input voltage is −0.5V.

NOTE: Permanent device damage may occur if the above **Absolute Maximum Ratings** are exceeded. Functional operation should be restricted to the conditions as detailed in the operational sections of this data sheet. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

This device contains circuitry to protect the inputs against damage due to high static voltages or electric fields. However, it is advised that normal precautions be taken to avoid application of any voltage higher than maximum rated voltages to this high impedance circuit.

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October 1991
Edition 2.0

FUJITSU

DATA SHEET

MB98A9060x-20/9070x-20/9080x-20/9090x-20 SRAM MEMORY CARD

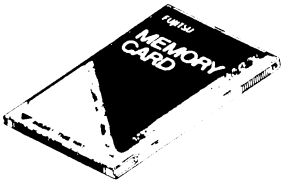
STATIC RANDOM ACCESS MEMORY CARD
64K / 128K / 256K / 512K-BYTE

The Fujitsu MB98A9060x, MB98A9070x, MB98A9080x and MB98A9090x are Static Random Access Memory (SRAM) cards capable of storing and retrieving large amounts of data. The memory circuits are housed in a credit-card sized 68-pin package. Internal circuitry is protected by two metal panels, one at the top and the bottom of the card, that help to reduce chip damage from electrostatic discharge.

When the SRAM card is not powered by its system, an on-board, replaceable lithium battery (coin-type) is used to retain data. When the lithium battery must be replaced, two rechargeable batteries that are built into the SRAM card, maintain data. (See the BLOCK DIAGRAM for location of batteries.)

A unique feature of the Fujitsu memory cards allows the user to organize the card into either an 8-bit or a 16-bit bus configuration. All cards are portable and operate on low power at high speed.

In accordance with the Personal Computer Memory Card Internal Association (PCMCIA) and Japan Electrical Industry Development Association (JEIDA) industry standard specification, SRAM cards offer additional EEPROM memory that is used to store attribute data. The attribute memory is an SRAM memory card option. (See page 2 for a description of the three available options.)



CRD-68P-M04

- PCMCIA and JEIDA industry standard for 68-pin memory card
- Credit card size dimensions: 85.6mm (length) x 54.0mm (width) x 3.3mm (thick).
- PCMCIA / JEIDA industry standard, two-piece 68-pin connector (with a two-row built-in 68-pin replaceable)
- Replaceable lithium battery
- Built-in, rechargeable batteries for data retention during lithium battery replacement
- Battery voltage detect and write protect function

Fujitsu Microelectronics

ABSOLUTE MAXIMUM RATINGS (see NOTE)

Rating	Symbol	Value	Unit
Supply Voltage	VCC	−0.5 to +6.0	V
Input Voltage	VIN	−0.5 to VCC +0.5	V
Output Voltage	VOUT	−0.5 to VCC +0.5	V
Temperature under Bias	TBIAS	−10 to +60 *1	°C
Storage Temperature	TSTG	−20 to +65 *2	°C

Note: *1 This value does not apply to the replaceable battery.
*2 This value does not apply to the replaceable battery and data retention.

NOTE: Permanent device damage may occur if the above **Absolute Maximum Ratings** are exceeded. Functional operation should be restricted to the conditions as detailed in the operational sections of this data sheet. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

This device contains circuitry to protect the inputs against damage due to high static voltages or electric fields. However, it is advised that normal precautions be taken to avoid application of any voltage higher than maximum rated voltages to this high impedance circuit.

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November 1990
Edition 5.0

FUJITSU

DATA SHEET

MB1501/MB1501H/MB1501L
SERIAL INPUT PLL FREQUENCY SYNTHESIZER

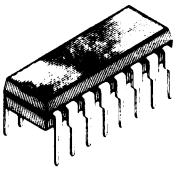
Fujitsu Microelectronics

SERIAL INPUT PLL FREQUENCY SYNTHESIZER WITH 1.1GHz PRESCALER

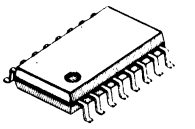
The Fujitsu MB1501/MB1501H/MB1501L, utilizing BI-CMOS technology, is a single chip serial input PLL frequency synthesizer with pulse-swallow function.

The MB1501 series contain a 1.1GHz two modulus prescaler that can select either 64/65 or 128/129 divide ratio; control signal generator; 16-bit shift register; 15-bit latch; programmable reference divider (binary 14-bit programmable reference counter); 1-bit switch counter; phase comparator with phase inverse function; charge pump; crystal oscillator; 19-bit shift register; 18-bit latch; programmable divider (binary 7-bit swallow counter and binary 11-bit programmable counter).

The MB1501 operates on a low supply voltage (3V typ) and consumes low power (45mW at 1.1GHz).



PLASTIC PACKAGE
DIP-16P-M04



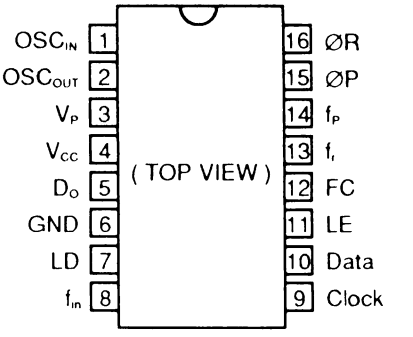
PLASTIC PACKAGE
FPT-16P-M06

MB1501 Product Line

	V_P Voltage	V_{OOP} Voltage	Lock up time	D_O Output Width	High-level Output Current	Low-level Output Current
MB1501	8V max	8.5V max	Middle speed	Middle	Middle	Middle
MB1501H	10V max	10.0V max	High speed	Low	High	Low
MB1501L	8V max	8.5V max	Low speed	High	Low	High

- High operating frequency: $f_{IN\ MAX}$=1.1GHz ($V_{IN\ MIN}$=0.20V_{P-P})
- On-chip prescaler
- Low power supply voltage: 2.7V to 5.5V (3.0V typ)
- Low power supply consumption: 45mW (3.0V, 1.1GHz operation)
- Serial input 18-bit programmable divider consisting of:
  - Binary 7-bit swallow counter (Divide ratio: 0 to 127)
  - Binary 11-bit programmable counter (Divide ratio: 16 to 2047)
- Serial input 15-bit programmable reference divider consisting of:
  - Binary 14-bit programmable reference counter (Divide ratio: 8 to 16383)
  - 1-bit switch counter (SW) Sets divide ratio of prescaler
- 2types of phase detector output
  - On-chip charge pump (Bipolar type)
  - Output for external charge pump
- Wide operating temperature: T_A=−40°C to +85°C

PIN ASSIGNMENT



This device contains circuitry to protect the inputs against damage due to high static voltages or electric fields. However, it is advised that normal precautions be taken to avoid application of any voltage higher than maximum rated voltages to this high impedance circuit.

ABSOLUTE MAXIMUM RATINGS (see NOTE)

Rating	Symbol	Condition	Value	Unit
Power Supply Voltage	V_{CC}		−0.5 to +7.0	V
	V_{PH}	MB1501H	V_{CC} to 12.0	V
	V_P, V_{PL}	MB1501/1501L	V_{CC} to 10.0	
Output Voltage	V_{OUT}		−0.5 to V_{CC} +0.5	V
Open-drain Output	V_{OOPH}	MB1501H	−0.5 to 11.0	V
	V_{OOP}, V_{OOPL}	MB1501/1501L	−0.5 to 9.0	
Output Current	I_{OUT}		±10	mA
Storage Temperature	T_{STG}		−55 to +125	°C

NOTE: Permanent device damage may occur if the above **Absolute Maximum Ratings** are exceeded. Functional operation should be restricted to the conditions as detailed in the operational sections of this data sheet. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

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FUJITSU

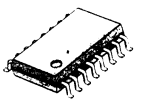
DATA SHEET

MB1507
SERIAL INPUT PLL FREQUENCY SYNTHESIZER

SERIAL INPUT PLL FREQUENCY SYNTHESIZER WITH 2.0GHz PRESCALER

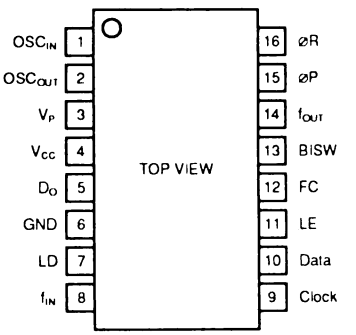
The Fujitsu MB1507 is a single chip serial input PLL frequency synthesizer designed for BS tuner and cellular telephone applications.
It contains a 2.0 GHz dual modulus prescaler which enables pulse swallow function, and an analog switch to speed up lock up time.
It operates supply voltage of 5.0V typ. and dissipates 18mA typ. of current realized through the use of Fujitsu's unique U-ESBIC Bi-CMOS technology.

- High operating frequency: $f_{IN\ MAX}$=2.0GHz ($V_{IN\ MIN}$=–4dBm)
- Pulse swallow function: 128/129 or 256/257
- Low supply current: I_{CC}=18mA typ.
- Serial input 19-bit programmable divider consisting of:
  - Binary 8-bit swallow counter: 0 to 255
  - Binary 11-bit programmable counter: 16 to 2047
- Serial input 15-bit programmable reference divider consisting of:
  - Binary 14-bit programmable reference counter: 8 to 16383
  - 1-bit switch counter (SW) Sets divide ratio of prescaler
- On-chip analog switch achieves fast lock up time
- 2types of phase detector output
  - On-chip charge pump (Bipolar type)
  - Output for external charge pump
- Wide operating temperature: –40°C to +85°C
- 16-pin Plastic Flat Package (Suffix: –PF)



PLASTIC PACKAGE
FPT-16P-M06

PIN ASSIGNMENT



ABSOLUTE MAXIMUM RATINGS (see NOTE)

Rating	Symbol	Value	Unit
Power Supply Voltage	V_{CC}	–0.5 to +7.0	V
	V_P	V_{CC} to 10.0	V
Output Voltage	V_{OUT}	–0.5 to V_{CC} +0.5	V
Open-drain Voltage	V_{OOP}	–0.5 to 8.0	V
Output Current	I_{OUT}	+10	mA
Storage Temperature	T_{STG}	–55 to +125	°C

NOTE: Permanent device damage may occur if the above **Absolute Maximum Ratings** are exceeded. Functional operation should be restricted to the conditions as detailed in the operational sections of this data sheet. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

This device contains circuitry to protect the inputs against damage due to high static voltages or electric fields. However, it is advised that normal precautions be taken to avoid application of any voltage higher than maximum rated voltages to this high impedance circuit.

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Fujitsu Microelectronics

May 1991

DATA SHEET

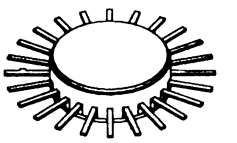
FUJITSU

MB1800 SERIES
High-Speed ECL

MB1800 Series 3G Bit/s High-Speed ECL

The Fujitsu MB1800 series is a hizgh-speed ECL fabricated with the Fujitsu ESPER (Emitter-base self-aligned structure with polysilicon electrodes and resistors) process. This series is suitable to be used in applications such as computers, telecom equipment, and instrumentation.

- Gate delay: 75 ps typ.
- Input frequency: 3 G Bit/s typ.
- F/F toggle clock frequency: 4 GHz typ.
- Output rise/fall time: 95/75 ps typ.
- Power supply voltage compensation of I/O levels: 10 KH series compatible
- I/O matching impedance: 50 Ω
- Round 24-pin ceramic flatpack package:
  FPT (metal seal) MB180(1-22)-CF
  R_O = 6°C/W (conductive cooling)



Ceramic Package
FPT-24C-A03

Fujitsu Microelectronics

Series Device Descriptions

Part No.	Function	Propagation Delay Time tpd (typ.)	Operating Frequency fmax (typ.)	Power Dissipation W (typ.)
MB1801	Dual 2-input OR/NOR gate	250 ps		0.7
MB1802	Dual exclusive OR/NOR gate	260 ps, 310 ps		0.7
MB1803	Dual 2-input 2-output OR/NOR gate	310 ps		1.4
MB1804	2-input 4-differential output clock distributor	370 ps		1.3
MB1806	4-differential output clock distributor with duty control	550 ps		1.5
MB1810	D flip-flop with SET and RESET	460 ps	4.9 GHz	0.5
MB1811	Dual D flip-flop with SET and RESET	460 ps	4.9 GHz	0.95
MB1812	Quad D flip-flop with common SET and RESET	520 ps	4 GHz	1.8
MB1813	Dual toggle flip-flop with RESET	460 ps	4.7 GHz	0.9
MB1814	4-stage ripple counter with RESET		4.1 GHz	1.25
MB1820	Discrimination circuit		> 4 GHz (10 mV at 2.5 GHz)	0.9
MB1821	4 to 1 multiplexer		4.2 GHz	1.5
MB1822	1 to 4 demultiplexer		3.8 GHz	1.7

Note: Permanent device damage may occur if absolute maximum ratings are exceeded. Functional operation should be restricted to the conditions as detailed in the operation sections of this data sheet. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

This device contains circuitry to protect the inputs against damage due to high static voltages or electric fields. However, it is advised that normal precautions be taken to avoid application of any voltage higher than maximum rated voltages to this high impedance circuit.

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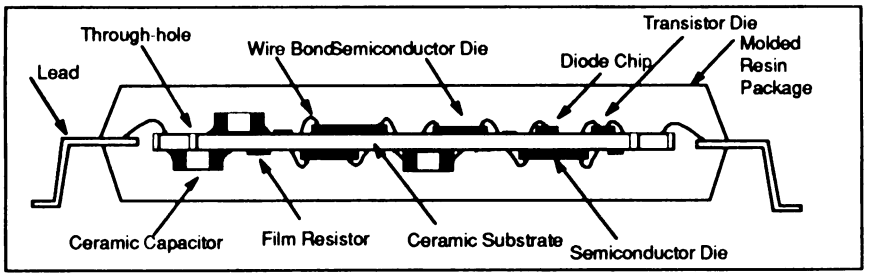
FUJITSU

Custom Hybrid IC Capabilities

Fujitsu Excels in Design Development and Support, Hybrid Technologies, Components, Packaging, and Manufacturing

SAN JOSE, CALIF. FUJITSU MICROELECTRONICS HDQTRS — Fujitsu's years of experience in micro- electronics design development and support, technology, packaging, and manufacturing makes it a leader in producing custom hybrid ICs to meet any customer need. Fujitsu has put almost 2,000 designs into production.

Design Capability and Support. With hybrid integrated circuit design experience since 1965, Fujitsu can offer expert design support to its hybrid customers. The design support begins at the Fujitsu Microelectronics, Inc. (FMI) San Diego Hybrid IC Design Center. The center is located in the United States to provide better service and faster turnaround for design.



Cross Section of Surface Mount Quad Flat Package (QFP)

Hybrid Technologies. Fujitsu has been producing hybrid integrated circuits since it developed thin-film technology in 1965. Thick-film development followed in 1967. Then in 1982, T-squared (T^2) constructionwas introduced. T^2 hybrid ICs combine thick- and thin-film technologies in a single package. In 1990, the Multi-chip Modules (MCMs) became the latest addition to Fujitsu's hybrid products. MCMs have the highest level of integration for a module packaged in a standard quad flat package.

Components. As one of the largest manufacturer of semiconductors, Fujitsu is able to provide all the components, including integrated circuit dies, mounted onto the hybrid IC. This capability guarantees design results and integrity.

Packaging. Fujitsu's packaging expertise has developed through its extensive experience with designing packages for all of its integrated circuits—from memories to ASICs. As a result of this experience, Fujitsu was able to develop a unique, one-of-a-kind package for its MCMs: the low cost, double-sided quad flat package.

Manufacturing. Production facilities are highly automated, with strict quality control from the beginning through the end of Fujitsu's manufacturing process. Design, component, and manufacturing reliability are all tested before a hybrid IC is shipped. Complete reliability is ensured before the hybrid IC leaves the plant.

Fujitsu's hybrid customers can expect the best hybrid packaged solution to any design problem.

Hybrid Highlights

Fujitsu's capabilities make it easy to meet any customer need, no matter how unique, with the best custom solution.

Film Technology
- Thick film
- Thin film
- T-Squared (T^2)

Substrate Materials
- Alumina
- FR4 (PCB)
- Silicon
- Aluminum nitride
- Multilayered ceramics

Component Mounting Methods
- Surface Mount
- Wire Bonding
- TAB (Future)
- Flip Chip (Future)

Available Packages
- Through-hole Types:
  - Single In-line (SIP)
  - Dual In-line (DIP)
  - Zig-Zag (ZIP)
- Surface Mount Types:
  - Quad Flat (QFP)
  - Custom Design

Operating Temperature Ranges
- 0° to 70°C (Standard)
- –40° to 85°C (Special)
- –40° to 105° (Future)

May 1990
Edition 1.0

FUJITSU

PRODUCT PROFILE

CG10 Series 0.8-micron CMOS Gate Arrays

DESCRIPTION

The CG10 series of 0.8-micron CMOS gate arrays is a highly integrated low-power, ultra high-speed product family that derives its enhanced performance and increased user flexibility from the use of a system-proven, dual-column gate structure and 2-layer metal interconnect technology. The unique dual-column gate structure increases density and speed performance, as well as gate utilization. CG10 architecture is fully compatible with Fujitsu's 1.5-micron UHB arrays.

Internal high-drive clock buffers minimize clock skew across the chip while internal bus performance and integrity is assured by incorporating 3-state transmission gate logic underneath the routing channels. Input buffer options include pull-up and pull-down resistance, Schmitt trigger, CMOS input, and clock driver. Output buffer options include 3-state, bidirectional, edge rate control, and high-drive output. The high-drive output buffers provide highly symmetrical output waveforms.

FEATURES

- High-density silicon gate CMOS technology
  - 3200 to 14,000 usable gates
  - 90% maximum utilization fully autorouted
- Ultra high speed
  - typical 0.5 ns/0.6 ns gate delay (power type/normal type)
  - narrow delay variation
- High sink current capability
  - 3.2 mA, 8 mA, 12 mA, and 24 mA options available
  - selectable edge rate control
- Low-skew clock signal distribution
  - High-performance clock drivers
  - Hierarchical clock distribution
  - Frequency-dependent clock routing
- Automatic test pattern generation
  - complete family of scan design macros available

DEVICE SPECIFICATIONS

Parameter	Value
Supply Voltage (V_{DD})	5 V ±0/25 V
Operating Temperature (T_{OP})	0 to 70°C Standard
Output High Voltage (V_{OH})	4.0 V min.
Output Low Voltage (V_{OL})	0.4 V max. (0.5 V max. at I_{OL} = 24 mA)
Input High Voltage (V_{IH})	2.2 V min.
Input Low Voltage (V_{IL})	0.8 V min.
Output High Current (I_{OH})	–2 mA, –4 mA, –8 mA
Output Low Current (I_{OL})	3.2 mA, 8 mA, 12 mA, 24 mA
Input Leakage Current (I_{LI})	±10 µA max. (for input and 3-state output)

PRODUCT FAMILY

Device Name	Available Gates[1]	Maximum Signal Pins[2]	Power Dissipation at 10 MHz	Available Packages[3]	
				Plastic	Ceramic
CG10272	3,256	108	150 mW	DIP, SDIP, QFP, PLCC, PGA	DIP, SDIP, QFP, LCC, PGA
CG10342	4,032	123	200 mW	DIP, SDIP, QFP, PLCC, PGA	DIP, SDIP, QFP, LCC, PGA
CG10492	5,572	148	200 mW	DIP, SDIP, QFP, PLCC, PGA	DIP, LCC, PGA
CG10572	6,510	163	200 mW	DIP, SDIP, QFP, PLCC, PGA	QFP, LCC, PGA
CG10692	7,684	163	250 mW	DIP, SDIP, QFP, PLCC, PGA	QFP, LCC, PGA
CG10103	11,080	188	250 mW	DIP, SDIP, QFP, PLCC, PGA	QFP, LCC, PGA
CG10133	14,720	220	250 mW	QFP[4]	PGA

[1] Gate count based on 2-input NAND
[2] Maximum signal pin numbers depend on the output drive requirements and the package selected.
[3] DIP = Dual in-line package, SDIP = Shrink-type DIP, QFP = Quad Flat Package, LCC = Leadless chip carrier, PLCC = Plastic LCC, PGA = Pin grid array
[4] Under development

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Fujitsu Microelectronics

January 1990
Edition 1.1

FUJITSU

PRODUCT PROFILE

CG21 Series 0.8-micron CMOS Gate Arrays

DESCRIPTION

The CG21 series of 0.8 µm CMOS gate arrays are currently available in five device types with from 30K to 100K gates. Three more CG21 arrays, ranging from 10K to 20K gates, are now under development. These arrays achieve the ultra fast speed of 0.37 ps per gate. Thanks to the channel-free (sea-of-gates) structure of the CG21 gate array, CG21 basic cells can be used for logic cells, memory cells, or wiring area in order to implement the desired functions. The full utilization of the array surface and the three-layer metal interconnect technology produce a 75 percent maximum gate usability ratio.

The logic and I/O cells for the CG21 series are functionally compatible with Fujitsu's AU, UHB, and CG10 series of gate arrays to simplify upgrading. User-specifiable RAM and ROM configurations are also available. These gate arrays facilitate the implementation of large-scale devices such as computer and graphic processors on single chips.

FEATURES

- 0.8 micron CMOS sea-of-gates technology
  –3 layer metal interconnect
- Ultra high speed
  – 0.37 ns/gate for 2-input NAND with F/O = 2
  – 0.55 ns/gate for power 2-input NAND with F/O = 2
- High basic cell usage
  – 75% maximum for logic with RAM/ROM
  – 45% maximum for logic only
- High sink current capability
  – sink current up to 12 mA, 24 mA planned
- Minimum delay clock buffer true option
- High current clock drivers
  –Low-skew clock signal distribution
- Extensive unit cell library (logic cell, RAM, ROM)
  –Unit cells functionally compatible with Fujitsu's AU, UHB, and CG10 gate array series
- Automatic test pattern generation optional
- On-chip pull-up/pull-down resistors
- High pin count plastic and ceramic packages
- High-density RAM and ROM compilers
  – up to 18K bit RAM compilation
  – up to 64K ROM compilation

Fujitsu Microelectronics

PRODUCT FAMILY

Device	Part Number	BCs on Chip (2-input gate +4 N-ch Tr)	Usable BCs	Max Signal I/O	Available Packages[1]	
					Plastic	Ceramic
CG21103	MBCG21103xxx[3]	10,224	75% max. for Logic with RAM,ROM 45% max. for Logic only (Preliminary values, to be upgraded)	108	SDIP-64, QFP-64, -80, -100, -120, PLCC-68, -84	PGA-64, 88, -135
CG21153	MBCG21153xxx[3]	15,486		142	SDIP-64, QFP-64, -80 -100, -120, -160, PLCC-68, -84	PGA-64, -88, -135
CG21203	MBCG21203xxx[3]	20,876		155	SDIP-64, QFP-64, -80, -100, -120, -160, PLCC-68, -84	PGA-64, -88, -135, -179
CG21303	MBCG21303xxx	31,500		178	QFP-120, -160	PGA-88, -135, -179, 208
CG21403	MBCG21403xxx	41,184		220	QFP-120, -160 SQFP-176[2], -208[2]	PGA-135, -179, 208, -256
CG21503	MBCG21503xxx	52,164		245	QFP-120, -160, -196[2] SQFP-176[2], -208[2]	PGA-135, -179, 208, -256, -299[2]
CG21753	MBCG21753xxx	75,140		284	QFP-196[2], -232[2] SQFP-176[2], -208[2]	PGA-135, -179, 208, -256, -299[2], -321[2], -361[2]
CG21104	MBCG21104xxx	102,144		332	QFP-196[2], -232[2] SQFP-208[2], -256[2]	PGA-135, -179, 208, -256, -299, -321[2], -361, -401[2]

[1]SDIP = Skinny dual in-line package, PGA = Pin grid array, QFP = Quad flat package, PLCC = Plastic leadless chip carrier, SQFP = Skinny quad flat package
[2]Planned
[3]Under development

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September 1990
Edition 1.0

FUJITSU

PRODUCT INFORMATION

CG31 Series 0.8-micron CMOS Gate Arrays

DESCRIPTION

The CG31 series of 0.8-µm CMOS gate arrays are currently available in three device types with from 120K to 200K gates. These arrays achieve the ultra fast speed of 0.37 ps per gate. Thanks to the channelless (sea-of-gates) structure of the CG31 gate array, CG31 basic cells can be used for logic cells, memory cells, or wiring area in order to implement the desired functions. The full utilization of the array surface and the three-layer metal interconnect technology produce a 65 percent maximum gate usability ratio.

The logic and I/O cells for the CG31 series are functionally compatible with Fujitsu's AU, UHB, CG10, and CG21 series of gate arrays to simplify upgrading. User-specifiable RAM and ROM configurations are also available. These gate arrays facilitate the implementation of large-scale devices such as computers and graphic processors on single chips.

FEATURES

- 0.8 micron CMOS sea-of-gates technology
  - 3 layer metal interconnect
- Ultra high speed
  - 0.37 ns/gate for 2-input NAND with F/O = 2
  - 0.55 ns/gate for power 2-input NAND with F/O = 2
- High basic cell usage
  - 65% maximum for logic with RAM/ROM
  - 55% maximum for logic only
- High sink current capability
  - sink current up to 12 mA, 24 mA planned
- Minimum delay clock buffer true option
- High current clock drivers
  - Low-skew clock signal distribution
- Extensive unit cell library (logic cell, RAM, ROM, PLA, etc.)
  - Unit cells functionally compatible with Fujitsu's AU, UHB, CG10, and CG21 series gate arrays
- Automatic test pattern generation optional with Fujitsu scan testing
- On-chip pull-up/pull-down resistors
- High pin count ceramic packages
- High-density RAM and ROM compilers
  - up to 18K bit RAM block
  - up to 64K ROM block

Fujitsu Microelectronics

PRODUCT FAMILY

Device	Available BCs (2-input gate +4 N-ch Tr)	Usable Logic Basic Cells (55% utilization)	Max Signal I/O
CG31134	129,540	71 K	300
CG31164	160,930	88 K	332
CG31204	210,188	115 K	332*

Note: * Package constrained

AVAILABLE PACKAGES[1]

Package	CG31134	CG31164	CG31204	Type
PGA-135	●	●	o	Cavity up
PGA-155	o	o	o	Cavity down
PGA-179	●	●	o	Cavity up
PGA-208	●	●	o	Cavity up
PGA-223	o	o	o	Cavity down
PGA-256	●	●	o	Cavity up
PGA-299	o	o	o	Cavity down[2]
PGA-321	o	o	o	Cavity down[2]
PGA-361	o	o	o	Cavity down[2]
PGA-401	—	o	o	Cavity down[2]

Notes: [1]All packages are ceramic pin grid arrays (PGAs).
[2]These packages feature 70-mil interstitial pin arrangement and metal heatspreader with optional heatsink
● = available
o = under development

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September 1990
Edition 2.0

FUJITSU

PRODUCT PROFILE

MB53xxx
FURY™ Series GaAs Gate Arrays

DESCRIPTION

The Fujitsu FURY gate array series incorporates Fujitsu's 0.8–micron GaAs self-aligned gate process to produce a family of devices ideally suited to the highest performance applications. Incorporating very high speed, high density, and low power dissipation, they provide the designers of mainframe and superminicomputers, high end workstations, telecommunications equipment, and fast instrumentation with the "edge" necessary to create unparalleled state-of-the-art products.

Flexible I/O structures allow interconnection between FURY arrays and devices operating at ECL, TTL, or GaAs signal levels. Mixed signals are permissible, allowing optimal interconnect performance. FURY designs are supported on a variety of popular workstations.

Direct Coupled FET Logic (DCFL) is used in the implementation of arrays varying in size from 3584 to 30528 2-input NOR gate equivalents. Like all Fujitsu products, these arrays are built to the highest standards of quality and reliability.

FEATURES

- High performance logic:
  80 ps/gate typical at 1.1 mW
- High interconnect performance:
  177 ps/gate typical at 1.1 mW
- I/O options:
  –ECL: 10K, 10KH or 100K
  –TTL
  –GaAs
- Low speed power product:
  0.025 pJ typical for 2-input NOR
- High speed I/O:
  1 GHz for GaAs and ECL interfaces
- Packaging solutions:
  Supplied with pre-attached heat sinks

Fujitsu Microelectronics

Device Name	Gate Count	Input Cells			I/O Cells		Total Signal Pins	Package Options
		TTL	ECL GaAs	Hi-drive	TTL	ECL GaAs		
MB53030	3584	40	40	4	52	52	92	132-pin QFP
MB53050	6400	52	52	4	68	68	120	149-pin PGA 164-pin QFP
MB53100	13376	74	74	8	100	100	174	211-pin PGA
		96	96	8	100	100	196	256-pin QFP
MB53150	16896	74	74	8	100	100	174	211-pin PGA
		96	96	8	100	100	196	256-pin QFP
MB53300	30528	100	100	8	156	156	256	344-pin QFP
MB53208 with RAM	20736 with 8K RAM	100	100	8	156	156	256	344-pin QFP

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The Fujitsu FURY series gate array family is alternately sourced by Vitesse Semiconductor Corporation, U.S.A.

FUJITSU

FUJITSU ASIC DESIGN SUPPORT

FUJITSU ASIC VERIFICATION TOOL – "FAVERIT™"

Designing high-performance ASICs requires close correlation between simulation and actual silicon to ensure first-time success. The designer also needs to simulate at the system level to ensure that the ASIC works correctly in the system.

With the certified utilities from Fujitsu, such as Logic Design Rule Check (LDRC), Test Data Rule Check (TDRC), and Delay Calculator, the designer ensures the quality of the ASIC design before committing to silicon. These same utilities, along with the Reference Simulator, are used by Fujitsu to validate the design. Fujitsu stands by the quality of any design produced with FAVERiT.

LDRC and TDRC are 100% correlated with Fujitsu's mainframe rule checks. Listing files provide complete summaries of results including warnings and errors. Delays are calculated from estimated wire lengths for pre-layout simulation and from actual wire lengths for post-layout simulation.

The FAVERiT simulator, intended for ASIC chip-level simulation, is 100% correlated with Fujitsu's mainframe simulator. Simulation results are provided in a listing file that summarizes chip performance, including warnings and errors. Verification programs include chip-level verification of logic design rules and test data files.

Because designs that have successfully simulated on FAVERiT are sure to pass Fujitsu's mainframe simulations as well, designers realize significant savings in time and engineering expenses.

Your FAVERIT Kit Includes:

- Symbol Libraries for schematic capture
- Simulation Libraries for functional and timing simulation
- Delay Calculator for pre-layout and post-layout delay calculation with highest accuracy and precision
- Logic Design Rule Checker
- Test Data Rule Checker
- Fujitsu's own simulator (certified to be 100% correlated to silicon)

FUJITSU SUPPORTS POPULAR CAD TOOLS

Technology	CAE Tool	Mentor	Dazix	Valid	Viewlogic	HP	Verilog-XL	VeriTime	Synopsys	IKOS	Amadeus *	Gate Ensemble
CMOS Channeled Gate Array	UHB (1.5µ	●	●	●	●	●	●	■	●	●	●	■
	CG10 (0.8µ)	●	●	●	UD	■	●	■	●	■	●	■
CMOS Channelless Gate Array	AU SoG (1.2µ)	●	●	●	●	●	●	■	●	●	●	●
	CG21/CG31 SoG (0.8µ)	●	●	●	UD	■	●	UD	●	●	●	●
CMOS Standard Cell	AU–SC (1.2µ)	●	●	●	■	●	●	■	●	■	●	■
ECL	ET, ET-H	●	●	●	■	●	▼	■	▼	▼	■	■
BiCMOS	BC, BC-H	●	■	■	■	●	■	■	■	■	■	■

Notes:
● Available Now ■ Not Available UD Under Development ▼Fixed-delay models only * Amadeus: Cadence's Design Framework

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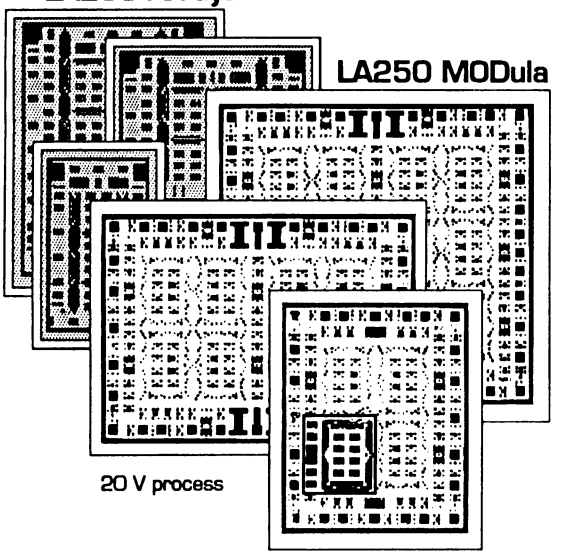
ViewCAD™ is a trademark of Fujitsu Limited
Work*view*™ is a trademark of View*Logic*, Inc.
VERILOG™ is a trademark of Cadence Design Systems, Inc.
UNIX™ is a trademark of Bell Telephone Laboratories, Inc.
XWindow™ is a trademark of MIT

GENNUM CORPORATION

The Preferred Source for Analog ASICs

LA200 Arrays



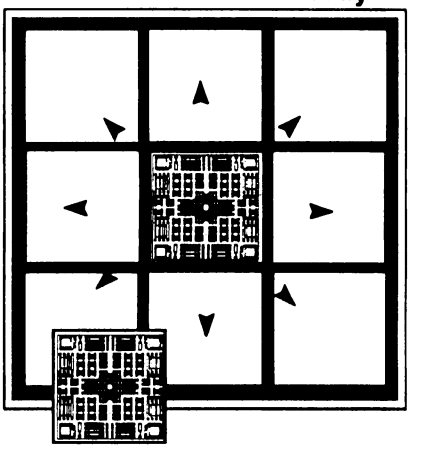
LA200 SERIES – THREE SIZES OF ARRAYS
with active & passive components

LA250 SERIES – THREE SIZES OF ARRAYS
with flipped and repeated component modules

NPNs - large 100 - 300 mA, small, Schottky low noise
PNPs - split & multiple collectors
Junction capacitors - 75 pF

12 GHz process also available,
— for VHF requirements.

GA911 Tile-Based Array



GA911 ARRAY — one tile of active and passive components, repeatable up to 5 x 5 tiles.

2.5 GHz process
Low power 1 - 15 V operation
On a 5 x 5 tile array –
1100 NPN, 460 PNP, 76 bonding pads
PC-based design tools

for all your communications ICs ...
reduce cost, increase performance and reliability.

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Gennum Corporation

GENNUM
CORPORATION

RESONANT MODE CONTROLLERS

	CONTROL MODE	MAXIMUM FREQUENCY	SINGLE ENDED	PUSH PULL	OUTPUT HI / LO	SYNCHRO. SHUTDOWN	ASYNCHRO. SHUTDOWN
LD405	ZCS	1 MHz	YES	YES	LO	YES	NO
GP605	ZCS	2 MHz	YES	YES	LO	YES	NO
GP6040	ZCS	3 MHz	YES	NO	LO	YES	YES
GP6041	ZCS	3 MHz	YES	NO	HI	YES	YES

Gennum Corporation

APPLICATION NOTES

510 - 62 - 1 The GP605 in a Variable Frequency Zero Current Switching, Half Bridge Resonant Mode Power Supply.

510 - 63 - 1 The GP605 in a Variable Frequency, Zero Current Switching, Forward Mode Resonant Power Supply.

510 - 96 Retrofitting the GP6040 into a GP605 Circuit.

510 - 98 The GP6040 in a 50W Series Resonant Mode Power Supply.

600 - 11 IEEE Spectrum, May 1989, Resonant Mode Power Supplies: a primer

600 - 13 Designer's Guide: Resonant Mode Design Techniques Improve Switcher Performance.

KITS

X486 X486 Evaluation Board and 510 - 68 Assembly Manual

PACKAGING

Available in: Plastic SOIC
Plastic DIP
Ceramic Hermetic DIP
Commercial, Industrial and Hi - Rel Grades

CUSTOM CONTROLLERS

Gennum offers full custom and semicustom resonant mode controllers, as well as variants on our standard controllers.

GENNUM CORPORATION P.O. Box 489, Stn A, Burlington, Ontario, Canada L7R 3Y3 tel. (416) 632-2996 fax: (416) 632-2055 telex: 061-8525
Japan Branch: 301 Aoba Building, 3-6-2 Takanawa, Minato-ku, Tokyo 108, Japan tel. (03) 3441-2096 fax: (03) 3448-8991

GENNUM CORPORATION

GC413 Low Cost AGC Amplifier

FEATURES

- high stability of output level
- 40 dB AGC operating range
- adjustable AGC threshold
- adjustable release time
- levels adjustable with external components
- maximum frequency 200 kHz
- operates from standard 5V power supply

The GC413 is a low cost, high performance, easy to use 8 pin AGC amplifier. In the minimum component configuration it only requires four external capacitors. The output level is maintained constant over 40 dB variation of input signal. The GC413 can drive a 600 Ω load and can be operated with a power supply voltage of 4.6 to 20 volts. No adjustments are necessary.

Some potential applications are:

intercoms	answering machines	infrared remote controls
hands-free telephones	modems	ground-to-air voice systems
P.A. systems	voice control systems	ground-to-ground voice systems
voice recognition systems	security systems	airborne communications
ultrasonic remote controls	proximity detectors	special telephone applications
ultrasonic radars	sonar systems	

GC810 Low Voltage, Low Power Operational Amplifier

FEATURES

- low voltage design - operates on 1.0 V supplies
- low power consumption - 200 μA typ. supply current
- wide range of supply voltage: 1.0 to 24 V
- single or dual supply operation
- low input offset voltage: 1 mV typ.
- class AB output stage swings virtually rail-to-rail

The GC810 is a low voltage, low power 8 pin operational amplifier employing specialized circuit design techniques to achieve operation on supply voltages as low as 1.0 volt. The class AB output stage swings to within a single transistor saturation voltage of either supply rail, and the PNP input stage provides negative supply rail sensing capability.

Some potential applications are:

hand-held communications equipment	telephone sets
battery operated security systems	wireless microphones
industrial signal conditioning equipement	cordless telephones
medical signal conditioning equipment	

can be operated from a single cell watch battery

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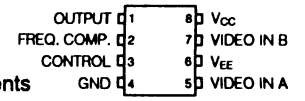
GT4122 VIDEO MULTIPLIER

- broadcast bandwidth to 30 MHz (±0.1 dB)
- 2 video inputs
- externally trimmed gain, spread & offsets
- 20 pin PDIP

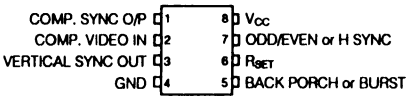
GT4123 VIDEO MULTIPLIER

- 20MHz ±0.1 dB video bandwidth
- 8 pin
- 2 video inputs
- no external adjustments



GS4881 SYNC SEPARATOR

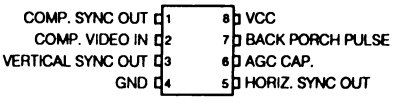
- optional odd/even or H-sync outputs
- optional back porch or burst outputs



GS4883 SYNC SEPARATOR

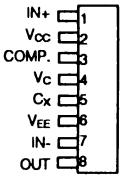
precision sync separator with

- 50% sync slicing
- precision slicer for broadcast applications



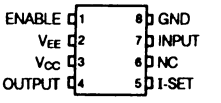
GB4550 INPUT BUFFER/CLAMP

- adjustable sync tip clamp
- ±0.1 dB B.W. to 25 MHz
- 8 pin SIP



GB4600 UNITY GAIN BUFFER

- wideband bus driver ±0.1 dB to 100 MHz in to 100pF load
- enable and low current selection pins
- ultra low differential gain and phase



D1/D2 SERIAL DIGITAL CHIP SET

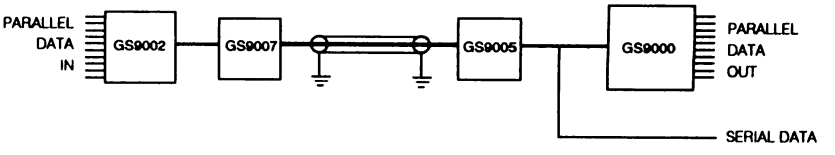
GS9000 – decoder — serial to parallel

GS9002 – encoder — parallel to serial

GS9004 – D1/D2 cable equalizer

GS9005 – D1/D2 receiver with equalizer and PLL

GS9007 – 75Ω cable driver



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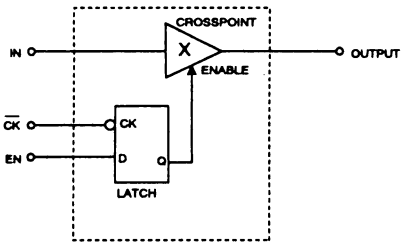
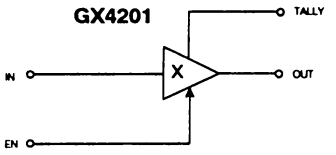
GX401



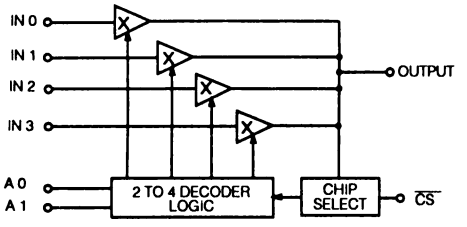
GX4201



1 x 1 (SPST) SWITCHES

- used in video routers and switchers
- NTSC/PAL/SECAM/HDTV formats
- 80 dB off isolation at 100 MHz
- <0.05%, <0.05° diff. gain & phase
- also suitable for low level RF signal switching, data and PCM switching
- expandable tri-state outputs
- 300 MHz -3 dB bandwidth

GX414/GX414A/GX434

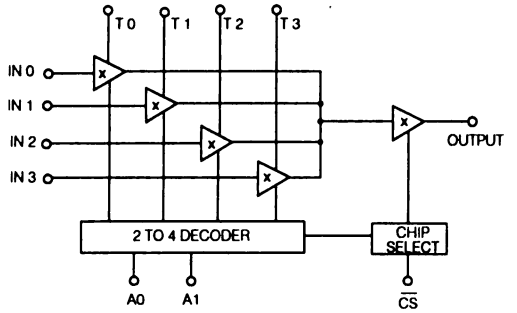


4 x 1 MULTIPLEXERS

- used in video routers and switchers
- NTSC/PAL/SECAM/HDTV formats
- 110 dB off isolation at 10 MHz
- 200MHz -3 dB bandwidth
- <0.05%, <0.05° diff. gain & phase
- also suitable for low level RF, PCM and data switching
- expandable inputs and outputs (tri-state)
- Tally outputs (on GX4404 only)

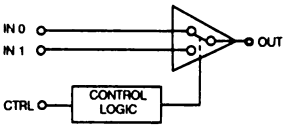
GX4404, GX4314

(TALLY OUTPUTS ON GX4404 ONLY)



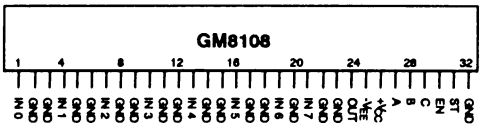
2 x 1 (SPDT) FAST TOGGLE SWITCH

- extremely fast toggle < 20 ns
- useful for pixel switching, HDTV, A/D, RF and PCM data routing
- 250 MHz -3 dB bandwidth



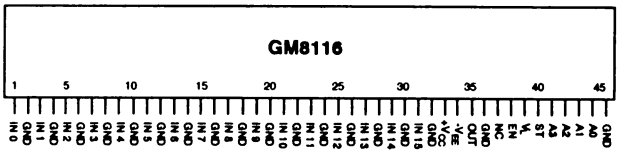
GY4102A

8 x 1 MUX MODULE



- stand alone multiplexers
- NTSC/PAL/SECAM and HDTV formats

16 x 1 MUX MODULE



- expandable for large matrices
- on-board logic decoding/latching

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Gennum Corporation

GOULD

AMI Semiconductors

Gould AMI was the first company to recognize the need for custom integrated circuits in the mid-1960's, and to pioneer the development of application-specific integrated circuits (ASICs). With more than a quarter century of dedication to providing ASIC system solutions, Gould AMI has more experience than any other vendor of ASICs.

The company now offers a continuum of CMOS ASIC products, ranging from programmable logic devices to complex Mixed-Signal ICs. This spectrum of offerings provides customers with a full range of ASIC choices, so that the optimum solution for an application can be selected.

Gould AMI's ASIC technologies allow system designers to tailor their systems and reduce the number of parts in their products by combining multiple memory and processing functions on a single device, instead of mixing and matching several standard parts. The result: smaller board sizes, lower final product cost and higher reliability. ASIC users also benefit by greater product differentiation due to custom tailoring and higher security ensured by an ASIC's resistance to duplication.

Capabilities

PLDs
1.25 and 2-micron CMOS electrically erasable programmable logic devices using PEEL™ technology—bipolar PAL and GAL replacements. Complex programmable logic devices in 1.25-micron CMOS electrically erasable PEEL array family. Look for future MIL-STD-883C versions of these popular products.

Gate Arrays
CMOS gate arrays available from 1,000-150,000 gates; over 600 macros in both 1- and 1.25-micron processes. Available with MIL-STD-883C or QML compliance.

Standard Cell ICs
Over 850 cells in Gould AMI's libraries, plus ROM, RAM, PLA and op-amp cell generators offer thousands of tailor-made solutions. MIL-STD-883C or QML compliance available.

Mixed-Signal ASICs
Gould AMI Offers MSDS (Mixed-Signal Design Solution)™ for automating the design, simulation, and test of mixed-signal chips for automotive, telecommunications, industrial, military 883C and consumer applications.

Foundry Service
0.8-micron (L-eff) to 5-micron MOS processes available for production; 15 years providing foundry service means well-documented design rules and efficient service. MIL-STD-883C processing available.

For more information, contact Gould AMI at (208) 233-4690.

Design Options and Second Sourcing
Libraries for popular workstations and PCs. NETRANS™ software service converts netlists in hours, providing an alternate source for gate array and standard cell designs independent of workstation library and process. PALTRANS™ for conversion of PLD designs to gate arrays.

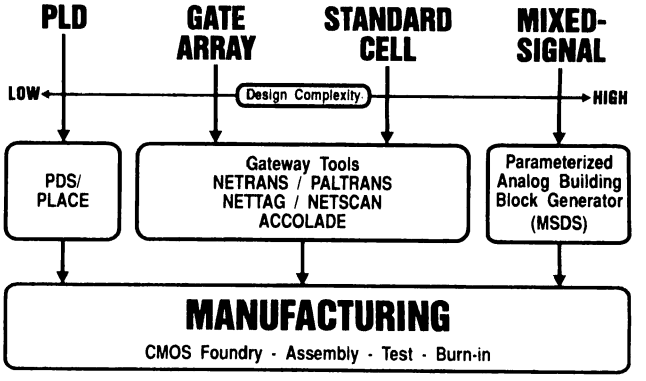
ROMs and Standard Products
16K to 4 megabit CMOS ROMs; station products, modems, filters and PCM products; 7720 and 77C20 DSPs; display drivers, many available compliant to MIL-STD-883C.

Packaging Capabilities
Wide range of options include standard dual-in-line packages (DIPs), pin grid arrays and chip carriers; surface-mount packages available from 16-256 pins, including small-outline IC packages, CLDCC, plastic and ceramic chip carriers, and EIJ quad flat packs.

Originators of the ASIC Continuum

Gould AMI's ASIC Continuum

A Continuum of Products to Satisfy Your Volume & Performance Requirements.



CMOS EEPLDs

User-programmable digital devices ideal for small and medium-scale integration

Electrically erasable programmable logic devices are ideal for small and medium-scale integration system design in low-volume production. Our lowest development cost ASICs, these devices deliver plenty of performance and offer a surprising measure of versatility and customer-control.

PEEL™ is a trademark of International CMOS Technology, Inc.

Built using our unique PEEL™ (Programmable Electrically Erasable Logic) technology, these PLDs are user-programmable, so there's no pre-production customer design and development risk. You may use PC-based or industry-standard PLD programmers to configure the macrocells and, if necessary, to repeatedly erase and reconfigure them.

The table below can help you select the right PLD for you. See the PLD section later in this catalog for detailed data sheets.

For a low-cost, low-risk avenue for conversions of EEPLDs to gate arrays, see PALTRANs Flow in ASIC Software Services section.

Gould AMI's CMOS PLD Family

Part No.	Architecture	Complexity	Speed	Replaces
18CV8	20 pin E²PLD	74 product terms x 36 input array	10/15/25ns Tpd	Bipolar PLDs
20CG10	24 pin E²PLD	92 product terms x 44 input arrays	15/25ns Tpd	20V8, 20G10
22CV10Z	24 pin E²PLD	132 product terms x 44 inputs	25ns Tpd	Bipolar PLDs Zero power mode
22CV10	24 pin E²PLD	132 product terms x 44 inputs	15/25ns Tpd	Bipolar PLDs
PEEL153	20 pin E²PLD	42 product terms x 36 inputs 10 sum terms x 32 product terms	30ns Tpd	Bipolar PLS153
PEEL173	24 pin E²PLD	42 product terms x 44 inputs 10 sum terms x 32 product terms	15/30ns Tpd	Bipolar PLS173
PEEL253	20 pin E²PLD	42 product terms x 36 inputs 20 sum terms x 42 product terms	30ncs Tpd	Bipolar PLS153 PEEL153
PEEL273	24 pin E²PLD	42 product terms x 44 inputs 20 sum terms x 42 product terms	15/30ns Tpd	Bipolar PLS173 PEEL173
PA7024	24 pin E²PMD	Over 80 sum of product terms	13/20ns Tpd	MULTI-PLDs
PA7040	40 pin E²PMD	Over 120 sum of product terms	13/20ns Tpd	MULTI-PLDs

Gate Arrays

Semi-finished digital chips provide high performance for medium volume production with quick development

- 1-micron triple or double metal and 1.25-micron double metal CMOS processes.
- Basic Logic, interface, MSI, and 7400 functions.
- Compatible with Gould AMI's megacell library.
- Custom RAMs available in both 1-micron and 1.25-micron processes.
- Artificial Intelligence Software Services available for netlist translation, gate reduction, clock-tree insertion, netlist analysis, and NETSCAN technology.

Gate arrays provide solutions for a variety of high performance digital applications--at a low development cost and quick design time. If you need fast turn production runs, gate arrays may be the right ASIC for you.

Gate arrays are semi-finished digital circuits that contain patterns of uncommitted transistors pre-fabricated on silicon base wafers. Using any major CAE workstation at your own facility, you can use Gould AMI libraries to customize your design as a network of logic functions. NETRANS is also available for conversion of any ASIC supplier's netlist to Gould AMI's bolt netlist format. With only the metal layers to fabricate, gate array development time is fast—typically four weeks.

Gould AMI's arrays are fabricated in a double (or triple) metal, single poly, twin-tub CMOS process. They offer the CMOS advantages of low power dissipation, broad power supply voltage range (2.5 to 5.5 Volts), and high noise immunity.

Over 600 macros in the process families include:

Basic functions:	Sequential and combinational logic.
Interface functions:	TTL and CMOS level inputs, TTL and CMOS Schmitt trigger inputs, pull-ups and pull-downs, TTL and CMOS output drivers, and output drivers with a controlled slew rate for lower noise operation.
MSI functions:	Counters, multiplexers, decoders, adders.
7400 functions:	Over 160 TTL compatible functions.
Digital megacells:	Megacells and compilers include 82xx, 29xx, core processors, RAM, FIFOs, DSP megacells, and many more.

1-micron Gate Arrays

Base Name	Raw Sites	Useable Gates: Triple Metal High	Useable Gates: Double Metal High	Useable Gates: Double Metal Low	Programmable Pad Count
GD200K*	(200,000)	(150,000)	(108,000)	(84,000)	(391)
GD120K*	(120,000)	(90,000)	(65,000)	(50,000)	304
GD 85K	(85,000)	(67,300)	(44,200)	(35,600)	256
GD 50K	49,168	36,900	26,600	20,600	200 (208)
GD 35K	34,163	25,600	18,000	14,500	160
GD 25K	25,248	18,900	13,500	10,700	140
GD 20K	20,590	15,400	10,900	8,800	128
GD 16K	16,016	12,000	8,300	6,400	110 (120)
GD 12K	12,012	9,000	6,100	5,100	92 (100)
GD 9K	9,281	7,000	4,900	3,900	84
GD 7K	7,200	5,400	3,700	3,200	72
GD 5K	4,988	3,700	2,600	2,100	60
GD 3K	2,580	1,900	1,400	1,000	44

* Devices currently in development
(nnnn) Estimated numbers for device or package in development

1.25-micron Gate Arrays

Array	Useable Gates	Programmable: TAB	Programmable: Fine Pitch	Programmable: Standard Pitch	Power Pins
GC100K	51,320	436	330	260	12
GC 50K	26,266	312	232	184	12
GC 40K	17,496	260	194	154	12
GC 30K	16,280	246	182	142	12
GC 25K	13,122	220	166	134	12
GC 20K	10,714	196	144	116	12
GC 15K	7,560	168	128	100	12
GC 10K	5,264	136	104	84	12
GC 7K	3,526	116	86	68	12
GC 5K	2,692	98	72	56	12
GC 3K	1,286	72	52	40	12

For more information, contact Gould AMI at (208) 233-4690.

GOULD

AMI Semiconductors

Standard Cell Circuits

Analog and digital building blocks offer higher density and smaller size for medium to high volume needs

- 1.0 and 1.25-micron double metal CMOS families
- 2-micron double poly, double metal CMOS families
- Cells created by expert-based cell generator
- Basic logic, interface, MSI, 7400 megacell functions
- 2-micron process includes analog functions
- Compiled ROMs and RAMs available
- Artificial intelligence software services available for digital netlist translation and gate reduction

Chips designed with these cells, offered in analog and digital formats, surpass gate array density and approach that of cell-based custom designs at half the development cost and development time. They're cost effective for medium to high-volume production.

Standard cells are pre-designed circuit building blocks whose functional, timing and performance parameters exist in Gould AMI's libraries. As with a gate array, you design a standard cell circuit by choosing logic functions from a library installed on a CAE workstation. But while a gate array design specifies only the final metal layers of a pre-fabricated silicon base, all of a standard cell's base and metal layers are custom fabricated from pre-characterized cells. This feature gives standard cells greater design flexibility, but requires an eight week development time.

Gould AMI

A standard cell circuit also uses only the number of cells required for a design, whereas gate arrays seldom utilize all of the available cells. This means a smaller die size and lower cost to you for a given circuit function.

Gould AMI offers over 850 cells in its four standard cell families:

- 1.0-micron digital CMOS (CYX Family).
- 1.25-micron digital CMOS (CAB Family).
- 2-micron analog and digital CMOS (ABX Family).

Digital Standard Cells

Both the CAB and CYX families use a double metal, single poly, twin tub CMOS process. They are intended primarily for 5 Volt operation but will operate down to 2.5 Volts.

Cells in these libraries include:

Basic functions:	simple gates, clock drivers, flip/flops, latches
Interface functions:	TTL, CMOS, Schmitt trigger, slew rate buffers, TTL with hysteresis
MSI functions:	counters, multiplexers, decoders, adders
7400 functions:	over 160 TTL compatible functions
Digital megacells:	RAM, ROM

Digital Megacell List

MG53C80	SCSI Interface Controller
MG80C85	8-Bit CMOS Microprocessor
MG82C12	8-Bit Input/Output Port
MG82C37A	Programmable DMA Controller
MC82C50A	Asynchronous Comm. Element
MG82C52	Serial Controller Interface
MG82C54	Programmable Interval Timer
MG82C55A	Programmable Peripheral Interface
MG82C59A	Programmable Interrupt Controller
MG82C84A	Clock Generator and Driver
MG82C88	Microprocessor Bus Controller
MG85C30	Serial Communications Controller
MGM1616A	16x16 Fast Multiplier
MGA1616A	16x16 Fast Adder/Subtractor

Analog/Digital Standard Cells

Gould AMI's ABX process is a 2-micron double poly, double metal process. This is Gould AMI's most flexible process, built on N or P-type starting material, with a range of 13 to 17 process layers. Ideal for mixed-signal analog and digital applications, it can operate from 5 to 10 volts. Functions include electrically erasable ROMs, implant programmable ROMs and NPN or PNP bipolar transistors on board.

Cells in the ABX libraries include:

Basic functions:	simple gates, clock drivers, flip/flops, latches
Interface functions:	TTL, CMOS, Schmitt trigger
MSI functions:	counters, multiplexers, decoders, adders
7400 functions:	over 160 TTL compatible functions
Analog functions:	Op amps, A/D, D/A, comparators, switches, voltage references, input buffer and output buffer

Cell-based Custom

Most tailored ASIC solution--best for high performance, mixed signal or high volume needs

For more information, contact Gould AMI at (208) 233-4690.

GOULD

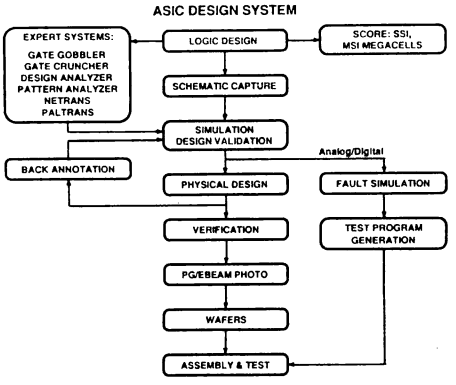
AMI Semiconductors

Cell-based custom chips use a combination of Gould's megacells, custom cells and standard cells to provide you with the ultimate in design tailoring and performance. This approach is ideal when you have a requirement for high speed, special interfaces, mixed analog/digital, or very high volume production runs.

Though their development costs and time are longer than with standard cells, cell-based custom circuits pack the most functions into the smallest area. Fewer custom chips need be used in a given design, thus saving board space. Custom devices also provide greater security because they are nearly impossible to copy.

Over twenty years' experience in custom design have given Gould AMI's design team the kind of engineering expertise that complex solutions demand. Particular areas of expertise are analog, mixed signal, high voltage and E2 applications. The following illustrate some examples of Gould AMI's answers to our customers' technical challenges.

Typical ASIC Development Flow



ASIC Software Services

Optional design services give you the power of choice and ease your designs

Unlike many ASIC vendors that accept only completed designs or finished netlists, Gould AMI is able to pick up an ASIC design at any stage, whether customers submit a partially finished design, a foundry-ready database tape, or a simple set of specifications. In order to ease logic design for its customers, Gould AMI has installed its analog and digital cell libraries on popular engineering workstations including Mentor Graphics, Daisy Systems, Intergraph, VALID Logic Systems, FutureNet and Viewlogic.

For more information, contact Gould AMI at (208) 233-4690.

Gould AMI uses several advanced expert systems in-house, each of which taps the combined experience of Gould AMI's engineers to accelerate device layout and design optimization.

ASIC Netlist Translation Services:

If a client has already designed a digital chip using another vendor's or their own proprietary tools, Gould AMI's NETRANS™ expert system will "translate" the netlist into Gould AMI-compatible form in just a few hours. This automated design transfer works independently of workstation libraries or processes, and can save customers thousands of dollars and weeks of precious time. For turning programmable logic device into gate arrays or standard cells, PALTRANS™ is the answer. PALTRANS converts standard programmable array logic (PAL), programmable electrically erasable logic (PEEL) and field programmable gate arrays (FPGAs) into netlists used to design gate array or standard cell ASICs. You can use an off-the-shelf PLD as a prototype for programming, debugging, and beta-testing logic designs, instead of first requiring the production of an ASIC. Engineers then use PALTRANS to convert the data into a netlist. In about eight hours, mask production can begin and an ASIC design is produced in two to three weeks.

Tools Speed Layout and Optimization

The SCORE™ cell compiler generates and tailors cells to a client's specific requirements in one-tenth the time required for hand-built cells.

Gate Gobbler, Gate Cruncher, Design Analyzer and Pattern Analyzer are artificial intelligence (AI) tools that assist with the conversion of conventional standard devices to CMOS ASICs.

Gould AMI offers an Automatic Test Generation tool, NETSCAN, that generates test vectors in a matter of hours, relieving designers of the task and saving at least six weeks for manual test generation. This tool automatically partitions a circuit into a set of combinatorial functions and inserts a scan path. Each function, seen as a distinct circuit, can be quickly and easily tested with an automatic test program generator employing the D-Algorithm.

Transitioning from standard TTL parts to ASICs can be fraught with difficulty, and when ASIC prototypes don't work, design re-work through traditional analysis and optimization techniques can take weeks or months. Gould AMI's AI tools minimize the delays caused by having to

re-work a design through traditional analysis and optimization techniques. The tools incorporate a continually expanding knowledge base, applying Gould AMI's hundreds of engineering man-years to every job.

Gould AMI: Your Mixed-Signal Solution

Gould AMI pioneered the development of the application specific integrated circuit in the late 1960's, and was one of the first companies to implement analog functions in ASICs. When you work with the engineers at Gould AMI, you tap into true in-depth expertise in analog and mixed-signal design. The engineers at Gould AMI have implemented hundreds of analog and mixed-signal ASICs over the past *twenty* years.

Cell-Based Custom Design— Flexibility, Efficiency and Security

Cell-based custom chips integrate the greatest possible number of functions into a given area, contribute to product differentiation, and enhance security, since they are difficult to copy. Cell-based custom circuits are ideal for high-speed requirements, special interfaces, very high volume production, and mixed-signal applications.

Gould AMI

Gould AMI's cell-based custom design methodology allows system designers ultimate flexibility in realizing mixed-signal ASICs. Gould AMI's Mixed-Signal Design Solution (MSDS) enables customers to design and simulate mixed-signal ASICs at their own facilities. MSDS can also be used in combination with Gould AMI designed megacells, custom cells and existing standard cells.

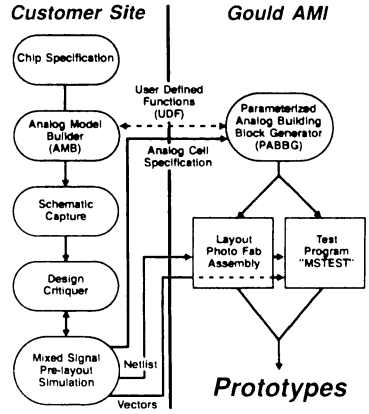
Mixed-Signal Design Solution

Gould AMI's MIXED-SIGNAL DESIGN SOLUTION (MSDS) consists of a suite of software tools for use both on customers' design work stations and at Gould AMI. MSDS is the most comprehensive mixed-signal design system to deliver a total design-to-manufacturing software solution for the swift creation of cost-effective, analog/digital ASICs with first-time silicon success. The system incorporates three capabilities critical to the cost-effective development of mixed-signal ASICs: 1) Automated generation of custom analog cells and behavioral level analog simulation models; 2) Simulation software that enables customers to perform behavioral-level, concurrent analog/digital simulations of their designs early in the ASIC design cycle; and 3) Mixed-signal test generation. Used in tandem with Gould AMI's mixed-signal fabrication processes, MSDS offers a comprehensive design-to-manufacturing solution to the challenge of complex mixed-signal ASIC design.

MSDS
MIXED SIGNAL DESIGN SOLUTION

For more information, contact Gould AMI at (208) 233-4690.

Mixed-Signal Design Solution Flow



Silicon Foundry Approach

Gould AMI is proud of the leadership position it occupies in today's fast-paced world of process and technology. Our Silicon Foundry services and capabilities are truly world class. We provide consulting services to our customers in the design, fabrication, packaging and testing of state-of-the-art digital, analog, and mixed-signal integrated circuits. All AMI manufacturing is performed under one of the most highly advanced real-time SPC environments in the semiconductor industry today.

Gould AMI's approach to Silicon Foundry services is your road to success. Whether you are a highly sophisticated circuit designer with *your own design* resources and facilities, utilize outside third-party design resources, or are simply seeking a second source to manufacture your already existing circuit, Gould AMI can provide you with cost-effective and timely semiconductor solutions. Gould AMI is a complete VLSI integrated circuit manufacturing facility with the capability to help you develop, produce and deliver CMOS and NMOS circuits.

At Gould AMI you will receive the very best in service, product quality, and cost-effective manufacturing available in the industry today. It is as simple as providing Gould AMI with a data base tape of your circuit in standard GDSII format. Digital, analog, or mixed-signal designs can be made to match any of the wide variety of Gould AMI's CMOS processes presently in use or under development. Our company-wide drive for improvement encourages continuous advances in processing technology and development. With over two decades of experience in custom and semi-custom integrated circuit manufacturing, Gould AMI provides a highly flexible and responsive team capable of meeting the rapidly changing needs of our customers in a world class manufacturing environment.

GOULD

AMI Semiconductors

GOULD AMI CMOS PROCESS FAMILY

Process Family	Geometry	Maximum Voltage	Characteristics
CMOS	1.0	5.5 Volts	Digital
CMOS	1.25	5.5 Volts	Digital
CMOS	1.5	5.0 to 12.0 Volts	Mixed Signal
CMOS	2.0	5.5 Volts	Digital
CMOS	3.0	5.0 to 10.0 Volts	Analog and Digital
CMOS	1.2	5.5 Volts	Digital
CMOS	5.0	5.5 to 12.0 Volts	Digital
CMOS	7.0	5.5 Volts	Analog and Digital
NMOS	3.0	5.5 Volts	Digital
NMOS	4.0	5.5 Volts	Digital
NMOS	5.	5.5 Volts	Digital

CMOS ROMs General Description

The Gould AMI family of ROMs are static mask programmable and organized by 8 bits. The device is fully TTL compatible on all inputs and outputs and uses a single +5V power supply. There are no requirements for clocks or refreshing, because they are static in operation. The three-state outputs facilitate memory expansion by allowing the outputs to be OR-tied to other devices. The control pin function and active level, as well as the memory contents, are user-defined.

Features

- 16K, 32K, 64K, 128K, 256K, 512K, 1M, 2M, 4M Selections
- Fast Access Time
- Mate With State-Of-The-Art 32 Bit Microprocessors
- Low Standby Power CMOS
- Fully Static Operation
- Single +5V ±10% Power Supply
- Directly TTL Compatible For Clean Interface
- Three-State TTL Compatible Outputs
- EPROM Pin Compatible
- Late Mask Programmable For Quick Turn Times
- Programmable Control Pins

Application of Gould ROMs

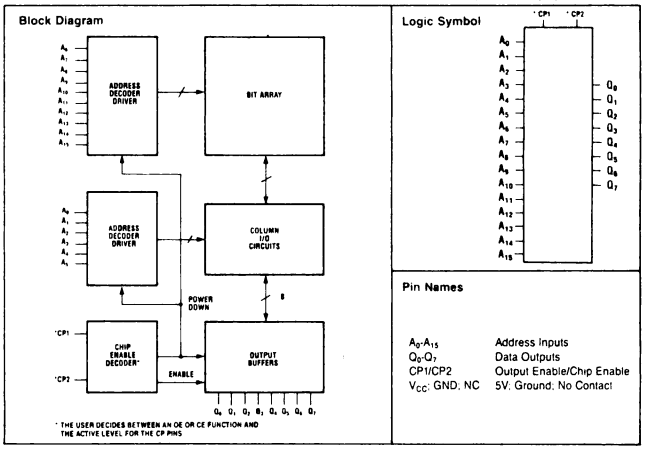
All of the ROMs offered by Gould are fully static, asynchronous, non-multiplexed devices. No matter what microprocessor you're using in your system, careful planning will give you the greatest flexibility in using our ever-expanding family of ROMs.

No Clocks Are Required

A clock is *not* required by our ROMs to latch addresses, precharge internal circuitry, or perform any other function. All control lines (CE, or OE) may remain in a valid read state for an indefinite period of time, during which the address inputs may be changed as desired to access various stored data.

For more information, contact Gould AMI at (208) 233-4690.

(512K Example)



Telecommunications Products

Station Products

- DTMF Tone Generators
- Pulse Dialers
- Digital Time/Space Crosspoint Switches

Modems, Filters and PCM Products

- 212A/V.22 MODEM Filter (with or without equalizers)
- BELL 103/V.21 Single Chip MODEM
- Single Frequency Tuneable Bandpass Filter
- Programmable Low Pass Filter
- Programmable High Pass Filter
- A-LAW Synchronous Combo CODEC w/Filters
- μ-LAW Synchronous Combo CODEC w/Filters
- Digital C Message Weighted/1 KHz Notch Filter
- Single Chip Conference Trunk
- Digital Signal Processor
- CMOS Digital Signal Processor

Display Driver Circuits

- 30-Volt Dichroic LCD Driver
- 32 Bit Driver

Gould AMI

GOULD

AMI Semiconductors

ABx Process

Gould AMI's CMOS, 1.5 micron digital, 3.5 micron analog, ABx Process is the industry's most flexible mixed-signal manufacturing process, allowing the system designer to produce complete systems on a chip. The process allows up to a maximum of 12 volts for the analog, and will accommodate a wide combination of functions, including 40v digital output drivers, electrically erasable programmable memory cells, Gould AMI's full standard cell library, mask programmable ROM and uncommitted collector bipolar capability. In addition, the analog voltage can run from −5v to +5v or from 0 to 10v. The 1.5 micron digital geometries allow high speed performance and reduced chip area.

Technology: 1.5μ Digital/3.5μ Analog Double Metal/Double Poly, P-well or N-well

Power Supply: 2.5v to 10v
- Digital 2.5v to 10v (12v max)
- Analog 5v to 10v (12v max)
- Single Ended or split
- On split supply, digital can be −v to +v, 0v to +v or −v to 0v

Temperature Range: −55°C to 125°C

Standard Cells:
- 183 cell digital library
- 5v and 10v libraries available
- Analog—Parameterized Analog Building Block
- Compiled RAM and ROM. Optimized to customer requirements.

Resistors:

Type	ohms/sq.	Matching	Tempco (abs)
p+	65-95	±0.4%*	.2%/°C
n+	45-75	±0.4%*	.2%/°C
poly	20-40	±0.4%	.1%/°C
p-well	2k-4k	±0.12%**	.8%/°C
n-well	1.5k-4k	±0.12%**	.8%/°C

* plus .02%/volt ** plus 1%/volt

Capacitors:
Type: poly to poly
Value: .69 fF/μ² ±6%
Matching: ±0.08% (+.001%/volt)
Tempco (abs): 0.003%/°C

Digital Logic:
Prop Delay: Typical NAND Gate - 0.8ns (.5pf, 5 volt operation, fan out = 2)
Clock Speed: Approx. 50MHz operation

EEPROM: **Five arrays available:**
2 words by 16 bits
4 words by 16 bits
8 words by 16 bits
16 words by 16 bits
32 words by 16 bits
Single bit cells
Other sizes of arrays available on custom basis

Other Processes

Other processes are available for mixed-signal design using 3μ and 5μ feature sizes. The 5 micron process offers the advantage of 15 volt operation.

For more information, contact Gould AMI at (208) 233-4690.

HFA1100, HFA1120, HFA1130

HARRIS

PRELIMINARY

October 1991

Ultra High-Speed Current Feedback Amplifier

Features

- Wide-Unity Gain Bandwidth 850MHz
- Very Fast Slew Rate 2500V/μs
- Fast Settling Time (0.1%) 11ns
- Excellent Gain Flatness (100MHz) 0.14dB
  (50MHz) 0.04dB
  (30MHz) 0.01dB
- High Output Current 60mA
- Internal Output Limiter Clamp for Fast Overload Recovery
- User Programmable Output Voltage Clamp (HFA1130)

Applications

- Pulse and Video Amplifiers
- Wideband Amplifiers
- RF/IF Signal Processing
- Flash A/D Driver

Description

The HFA1100, 1120, 1130 are a family of high-speed, wideband, fast settling current feedback amplifiers. Built-in Harris' proprietary complementary bipolar UHF process, these devices are the fastest monolithic amplifiers available from any semiconductor manufacturer.

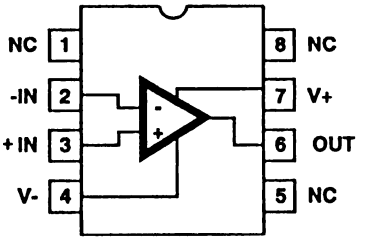
The three devices, available in 8-pin CERDIP, PDIP, and SOIC's, have similar performance, but each offers separate features.

The HFA1100 is a basic model with uncommitted pins 1, 5, and 8. The HFA1120 includes inverting input bias current adjust pins (pins 1 and 5) for adjusting the output offset voltage. The HFA1130 allows independent adjustment of the clamp's positive and negative levels via pins 5 and 8. All three models provide an internal limiter clamp for fast overload recovery.

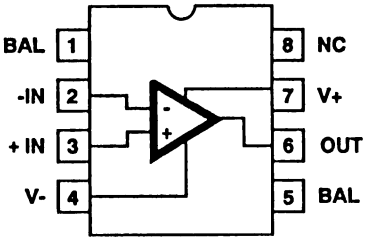
These devices offer a significant performance improvement over the AD9617/18, the CLC400/401/404, the CLC500/1/2/5, and the EL2070.

Pinouts

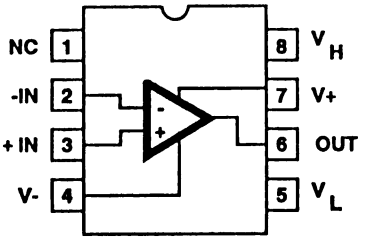
HFA1100
TOP VIEW



HFA1120
TOP VIEW



HFA1130
TOP VIEW



Ordering Information

MODEL NUMBER	OPERATING TEMPERATURE RANGE	PRODUCT DESCRIPTION
HFA1100MJ, HFA1120MJ, HFA1130MJ	–55°C to +125°C	8 LD Ceramic DIP
HFA1100IJ, HFA1120IJ, HFA1130IJ	–40°C to +85°C	8 LD Ceramic DIP
HFA1100IP, HFA1120IP, HFA1130IP	–40°C to +85°C	8 LD Plastic DIP
HFA1100IB, HFA1120IB, HFA1130IB	40°C to +85°C	8 LD SOIC

Harris Semiconductor

CAUTION: These devices are sensitive to electrostatic discharge. Proper I.C. handling procedures should be followed.

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File Number **2945.1**

HARRIS

HFA1110

PRELIMINARY

October 1991

Ultra High-Speed Closed Loop Buffer Amplifier

Features

- Wide –3dB Bandwidth 700MHz
- Very Fast Slew Rate.....2500V/μs
- Fast Settling Time (0.2%) 7ns
- High Output Current 60mA
- Excellent Gain Accuracy 0.99V/V
- User Programmable For Closed-Loop Gains of +1, –1 or +2

Applications

- RF/IF Processors
- Driving Flash A/D Converters
- High-Speed Communications
- Impedance Transformation
- Line Driving

Description

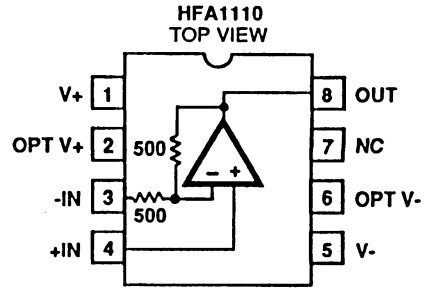
The HFA1110 is a closed loop current feedback buffer amplifier that achieves a high degree of gain accuracy, wide bandwidth, and low distortion. Manufactured on Harris' proprietary complementary bipolar UHF process, the HFA1110 also offers very fast slew rate, excellent gain flatness, and high output current.

A unique feature of the circuit pinout allows for voltage gains of +1, +2, and –1, while maintaining compatibility with the standard (gain of +1) buffer pinout (see Pinout). By leaving pin 3 open and applying the input to pin 4, the circuit defaults to the standard gain of +1. Grounding pin 3 and applying the input to pin 4, results in a gain of +2. Finally, by using pin 3 as an input and grounding pin 4, a gain of –1 can be achieved.

The device offers performance and functionality advantages over the AD9630, CLC110, and others.

The device is available in 8-pin CERDIP, PDIP, and SOIC packages.

Pinout



Pin Descriptions

NAME	PIN NUMBER	DESCRIPTION
V+	1	Positive Supply
Opt V+	2	Optional Positive Supply
IN–	3	Inverting Input
IN+	4	Non-Inverting Input
V–	5	Negative Supply
Opt V–	6	Optional Negative Supply
NC	7	No Connection
OUT	8	Output

Ordering Information

MODEL NUMBER	OPERATING TEMPERATURE RANGE	PRODUCT DESCRIPTION
HFA1110MJ	–55°C to +125°C	8 LD Ceramic DIP
HFA1110IJ	–40°C to +85°C	8 LD Ceramic DIP
HFA1110IP	–40°C to +85°C	8 LD Plastic DIP
HFA1110IB	–40°C to +85°C	8 LD SOIC

Harris Semiconductor

CAUTION: These devices are sensitive to electrostatic discharge. Proper I.C. handling procedures should be followed.

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File Number **2944.1**

HARRIS

HTA1000

July 1991

EBHF Tile Array

Features

- Supported on the Harris FASTRACK™ Design System
- High-Frequency Dielectrically Isolated 40 Volt Complementary Bipolar Process
- High-Performance Cell Library
- Cell Macromodels Available for Fast Simulation
- Transistor Level Design Also Supported
- F_T = 0.5GHz
- User Definable NICr Resistors
- Devices Include PJFET's, Surface Zeners, and MOS Capacitors
- Personalized by Two Metal Interconnect, Via, and One NICr Resistor Level
- Lower NRE Charges Compared to Full Custom
- Minimum Turnaround Times for First Silicon

Applications

- General Analog System Implementation
- Consolidation of Discrete Components and Analog ICs
- Reduce Size and Cost, Increase Reliability and Performance
- Quick-turn, Low Cost, IC Design Verification
- Design Feasibility Units or System Demonstration Units
- Development of Production Units for Low Volume Systems

Overview

The Harris HTA10000 tile array provides the analog system designer with a fast-turn, low-cost tile array methodology for the design of high performance, high-speed analog circuits and systems. The HTA1000 is supported on the Harris FASTRACK design system, and is implemented using the Harris dielectrically isolated EBHF production process. Simulation capability on FASTRACK is available to the designer, including a combination of deterministic and statistical analysis modes. These modes provide the designer with a statistical analysis of circuit performance, and a method for detailed investigations of parametric yield.

The HTA1000 tile array incorporates an extensive library of high-performance analog cells. This library includes op amps, comparators, sample/holds, references, and differential video circuits. Each cell has a companion macromodel which, when substituted, will significantly reduce circuit simulation time for preliminary system level analysis. Interconnect of the cells is implemented by personalizing two levels of metal and custom and via design of NiCr resistors. Utilizing the electrical and physical design tools of FASTRACK, transistor level design is supported using portions of the array not dedicated to implement tile array cells. Final circuit simulations may include cells represented at the device level and/or macromodel level in order to obtain any desired combination of simulation speed and accuracy.

Base wafers are processed up to the resistor and interconnect levels and are then inventoried at the factory, providing rapid silicon turn-around receipt of a customer's design.

Harris Semiconductor

Description

The HTA1000 tile array contains 10 identical tiles of active components as shown in Figure 1. Also included are a number of large bipolar transistors, regions of active and passive components and 40 bond pads. The tile array contents are summarized at the end of this description. Within each of the tiles is ample space for the construction of custom NiCr resistors and inter-tile routing.

Each of the tiles is capable of becoming any of the cells in the library with minor limitations. The architecture of a single tile is depicted in Figure 2. The designer first assigns a cell type, from Table 1, to each tile. FASTRACK automatically adds the appropriate interconnect and other levels to those tiles to generate the desired cells. The designer then builds NiCr resistors as needed, and interconnects them with the cells, other components, and bond pads to produce the final layout.

The user may also design circuitry at the device level with those transistors not used for cell configurations. The transistor device characteristics are shown in Table 2, with the devices available in each tile listed in Table 3.

When electrical simulation is completed, the layout is compared to the circuit/system diagram generated by the designer using the layout vs. schematic software. Discrepancies are displayed for evaluation. Layout design rule checks are then performed, and interconnect parasitics are extracted and back-annotated to the electrical description.

Tile Array Contents

- **Device Tile (10):** Each includes 71 active devices, 10 small capacitors, 4 diffused resistors, and large areas for trimmable NiCr resistors. See Figure 2.
- **Large Caps Tile (2):** Each includes 10 40pF large capacitors. See Figure 3.
- **Large NPN, PNP (24):** Includes 12 large NPN transistors and 12 large PNP transistors.
- **Pads (40):** Arranged 10 per side.

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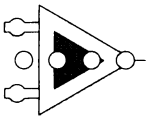
File Number **2931**



OP AMPS

Your Complete Source for High Per

High Speed

P/N	Description	BW at Min. Acl (MHz)	Slew Rate (V/μS)	Settling Time (to 0.1%)	Offset Voltage @ 25°C	Input Bias Current	Differential Phase (Deg.)	Differential Gain (%)	Output Current (+/- mA)
HFA1130*	870 MHz Op Amp with Output Limiter Clamp	870 (-3db)	2500	11nS	2mV	12μA	TBD	TBD	60mA
NEW HFA1100*	870 MHz Current Feedback Unity Gain Stable Op Amp	870 (-3db)	2500	11nS	2mV	12μA	TBD	TBD	60mA
NEW HA5020	100MHz Current Feedback Video Amplifier	100 (-3dB)	800	90nS	2mV	3μA	0.03	0.02	65mA
NEW HFA-0001	High Slew Rate, Wideband, Unity Gain Stable Op Amp	350	875	25nS	6mV	15μA			50mA
HFA-0002	Low Noise, Wideband (Acl ≥ 10)	1 GHz	250	50nS	0.6mV	0.23μA			12mA
HFA-0005	High Slew Rate, Wideband Unity Gain Stable Op Amp	300	420	20nS	6mV	15μA			50mA
NEW HA2839 HA2840	Very High Slew Rate, Wideband Op Amp (Acl ≥ 10)	600	625	180nS	0.6mV	5μA	0.03	0.03	20mA
NEW HA2841	Fast Settling Video (Acl ≥ 1)	54	240	90nS	1mV	5μA	0.03	0.03	15mA
NEW HA2842	High Output Current, High Slew Rate, Video (Acl ≥ 2)	80	375	100nS	1mV	5μA	0.02	0.03	100mA
NEW HA2850	Low Power, Wideband (Acl ≥ 10)	470	340	200nS	0.6mV	5μA	0.04	0.04	20mA
HA5004	100 mA Output, Current Feedback Amplifier	100 (-3dB)	1200	50nS	1mV	2μA	0.15	0.035	100mA
HA2544	Video Op Amp (Acl ≥ 1)	45	150	120nS	6mV	7μA	0.05	0.23	35mA
CA3450	Video Line Driver (Acl ≥ 1)	200	440	35nS	8mV	0.1μA	0.3	0.6	100mA
CA5470	Quad, Single Supply (Acl ≥ 1)	14	5	1μS	6mV	0.5pA			5.5mA

*Samples, datasheets, new orders Feb '92

Precision

P/N	Description	BW at Min. Acl (MHz)	Slew Rate (V/μS)	Settling Time (to 0.1%)	Offset Voltage @ 25°C	Input Bias Current	CMRR (dB)	PSRR (dB)	Output Current (+/- mA)
NEW HA5221	Low Noise, Wideband (Acl ≥ 1)	35	25	1.5μS	300μV	40nA	95	100	56mA
NEW HA5222	Dual, Low Noise (Acl ≥ 1)	35	25	1.5μS	300μV	40nA	95	100	56mA
HA2548	Precision, High Slew Rate, Wideband Op Amp, (Acl ≥ 5)	150	120	200nS	300μV	5nA	90	95	33mA
HA5134	Precision, Quad (Acl ≥ 1)	4	1	13μS	50μV	10nA	120	120	20mA

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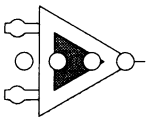


OP AMPS

formance Operational Amplifiers

Supply Range (+/-VDC)	Supply Current (mA/OpAmp)	Package Options	Temperature Range	High Rel. /883	Spice Models	100s Price From
4.5 - 5.5	21mA	Pdip, Cerdip, SOIC	-40°C to +85°C, -55°C to +125°C	X	X	$9.95
4.5 - 5.5	21mA	Pdip, Cerdip, SOIC	-40°C to +85°C, -55°C to +125°C	X	X	$9.95
5 to 15	7.5mA	Pdip, Mini-dip (Cer.), SOIC, Die	0°C to + 75°C, -40°C to +85°C, -55°C to +125°C	X	X	$2.85
4 to 6	65mA	Pdip, Cerdip, SOIC, Die	0°C to + 75°C, -40°C to +85°C, -55°C to +125°C	X	X	$7.57
4 to 6	14mA	Pdip, Mini-dip (Cer.), Metal Can, SOIC, LCC, Die,	0°C to + 75°C, -40°C to +85°C, -55°C to +125°C	X	X	$6.48
4 to 6	35mA	Pdip, Mini-dip (Cer.), Metal Can, SOIC, Die	0°C to + 75°C, -40°C to +85°C, -55°C to +125°C	X	X	$6.48
10 to 20	13mA	Pdip, Cerdip, Mini-dip (Cer.), Metal Can, SOIC, Die	0°C to + 75°C, -40°C to +85°C, -55°C to +125°C	X	X	$3.55
10 to 20	10mA	Pdip, Cerdip, Mini-dip (Cer.), Metal Can, SOIC, LCC, Die	0°C to +75°C, -40°C to +85°C, -55°C to +125°C	X	X	$3.75
10 to 20	15mA	Pdip, Cerdip, Mini-dip (Cer.),Metal Can, SOIC, LCC, Die	0°C to + 75°C, -40°C to +85°C, -55°C to +125°C	X	X	$4.00
10 to 20	7.5mA	Pdip, Cerdip, Mini-dip (Cer.), SOIC, Die	0°C to + 75°C, -40°C to +85°C, -55°C to +125°C	X	X	$3.75
5 to 18	12mA	Cerdip, Die	0°C to + 75°C, -40°C to +85°C, -55°C to +125°C	X	X	$6.75
10 to 20	10mA	Pdip, Mini-dip (Cer.), Metal Can, SOIC, LCC, Die	0°C to +75°C, -25°C to +85°C, -40°C to +85°C, -55°C to +125°C	X	X	$3.04
7.5, +14.5	30mA	Pdip	-40°C to +85°C			$2.96
+3 to +16	2mA	Pdip, SOIC, Die	-55°C to +125°C			$1.34

Supply Range (+/-VDC)	Supply Current (mA/OpAmp)	Package Options	Temperature Range	High Rel. /883	Spice Models	100s Price From
10 to 20	8mA	Mini-dip (Cer.), Metal Can, SOIC, LCC, Die	0°C to +75°C, -40°C to +85°C	X	X	$4.69
10 to 20	8mA	Mini-dip (Cer.), Metal Can, Die	0°C to +75°C, -40°C to +85°C	X	X	$9.14
10 to 20	12mA	Pdip, Mini-dip (Cer.), Metal Can, SOIC, LCC	0°C to +75°C, -40°C to +85°C	X	X	$4.54
5 to 18	1.6mA	Cerdip	0°C to +75°C, -55°C to +125°C	X		$5.75

High Rel /883

Mil-Std-883, Class B. Please contact your local sales office for a complete listing of Harris products processed to: Mil-Std-883, DESC SMD, JM38510 and Class S levels.

Harris Semiconductor

HARRIS

HI-5800

ADVANCED INFORMATION

December 1991

12 Bit, 3 MSPS A/D Converter

Features

- Throughput Rate ..... 3 MSPS
- Conversion Time 200ns
- 12 Bit No Missing Codes Over Temperature
- Buffered Sample and Hold Amplifier
- Precision Voltage Reference
- High Input Bandwidth
- Differential Linearity Error ..... 0.5 LSB (Typ)
- Integral Linearity Error ..... 0.75 LSB (Typ)
- High Speed Digital Interface
- CMOS/TTL Compatible

Applications

- High Speed Data Acquisition Systems
- Medical Imaging
- Radar Signal Analysis
- Vibration Analysis
- Waveform Spectrum Analysis

Description

The HI-5800 is a monolithic, 12 bit, CMOS sampling Analog-to-Digital Converter. It is a complete subsystem containing a sample and hold amplifier, voltage reference, two-step subranging A/D, error-correction, control logic, and timing generator. Only power and digital control signal are required. It is designed for high speed applications where wide bandwidth and low power consumption are essential.

The HI-5800 is available in commercial and industrial temperature ranges. It is available in a 40 pin ceramic DIP and a 44 pin PLCC package.

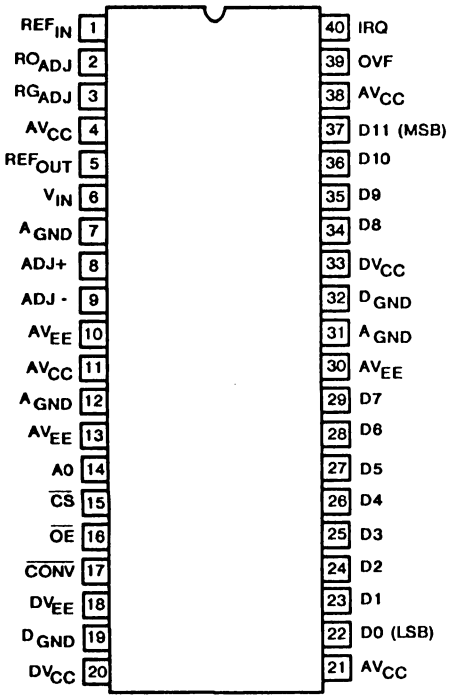
Ordering Information

PART NUMBER	TEMPERATURE RANGE	PACKAGE
HI5800JCJ*	$0^oC \leq T_A \leq +75^oC$	40 Pin Ceramic DIP
HI5800JCM*	$0^oC \leq T_A \leq +75^oC$	44 Pin PLCC
HI5800AIJ*	$-40^oC \leq T_A \leq +85^oC$	40 Pin Ceramic DIP
HI5800AIM*	$-40^oC \leq T_A \leq +85^oC$	44 Pin PLCC

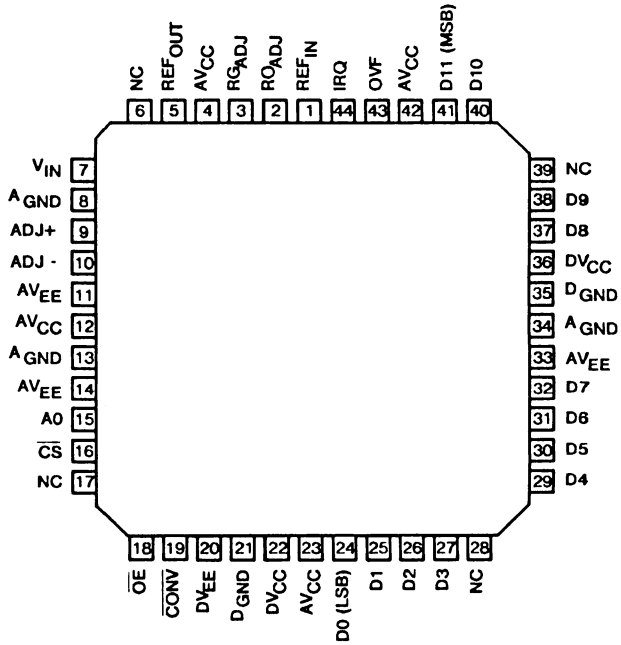
* Linearity (DNL) = 0.5 LSB and Sampling Rate = 3MHz (330ns)

Pinouts

40 LEAD CERAMIC DIP
TOP VIEW



44 LEAD PLASTIC LCC
TOP VIEW



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File Number 2938

HARRIS

HI-5700

PRELIMINARY

December 1991

8 Bit, 20MSPS Flash A/D Converter

Features

- 20MSPS Conversion Rate
- 12MHz Full Power Input Bandwidth
- No Missing Codes
- Sample and Hold Not Required
- 0.75 LSB Differential Linearity Error (Typical)
- CMOS/TTL Compatible
- Single +5V Supply Voltage
- Improved Replacement for MP7684

Applications

- Video Digitizing
- Radar Systems
- Medical Imaging
- Communication Systems
- High Speed Data Acquisition Systems

Description

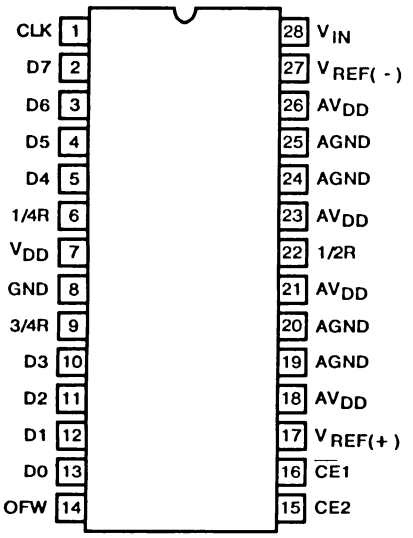
The HI-5700 is a monolithic, 8-bit, CMOS FLASH Analog-to-Digital Converter. It is designed for high speed applications where wide bandwidth and low power consumption are essential. Its 20MSPS speed is made possible by a parallel architecture which also eliminates the need for an external sample and hold circuit. The HI-5700 delivers 0.75 LSB differential nonlinearity while consuming only 550mW typically. Latched outputs are provided which present valid data to the output bus one clock cycle after the convert command is received. An overflow bit is provided to allow the series connection of two converters, thus achieving 9-bit resolution.

Ordering Information

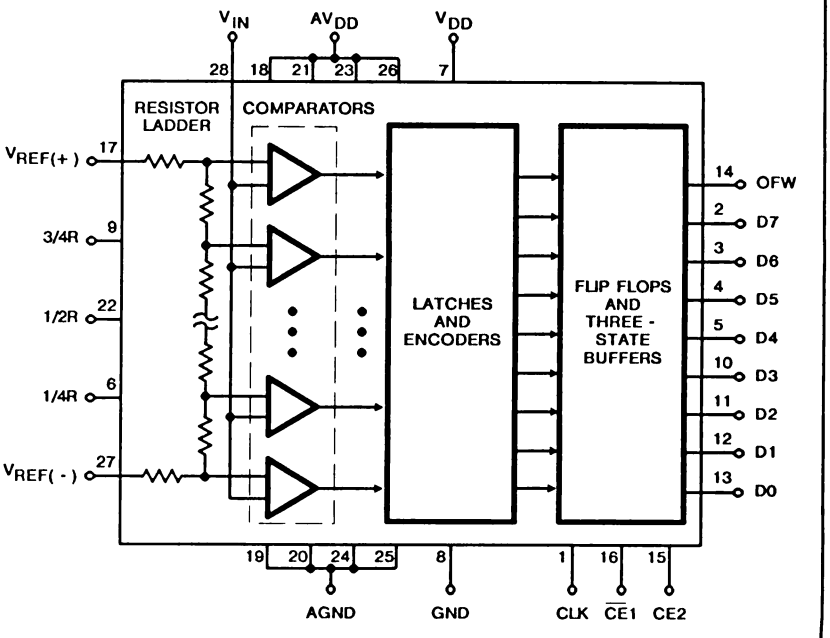
PART NUMBER	LINEARTY (DNL)	TEMP RANGE	PACKAGE
HI3-5700J-5	0.75 LSB	0° to +75°C	28-Pin Plastic DIP
HI9P5700J-9	0.75 LSB	0° to +75°C	28-Pin SOIC
HI3-5700A-5	0.75 LSB	-40°C to +85°C	28-Pin Plastic DIP
HI9P5700A-9	0.75 LSB	-40°C to +85°C	28-Pin SOIC

Pinout

28 PIN (PLASTIC DIP)
TOP VIEW



Simplified Block Diagram



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HARRIS SEMICONDUCTOR

HI-5701

PRELIMINARY

November 1991

6 Bit, 30 MSPS Flash A/D Converter

Features

- 30 MSPS with No Missing Codes
- Full Power Input Bandwidth 20MHz
- No Missing Codes Over Temperature
- 0.6 LSB Linearity ..... 20 MSPS (Max)
- Sample and Hold Not Required
- Single Supply Voltage .....+5V
- Low Power CMOS ..... 300mW (Max)
- CMOS/TTL Compatible
- Overflow Bit

Applications

- Video Digitizing
- Radar Systems
- Communication Systems
- High Speed Data Acquisition Systems

Description

The HI-5701 is a monolithic, 6 bit, CMOS flash Analog-to-Digital Converter. It is designed for high speed applications where wide bandwidth and low power consumption are essential. Its 30 MSPS speed is made possible by a parallel architecture which also eliminates the need for an external sample and hold circuit. The HI-5701 delivers ±0.7 LSB differential nonlinearity while consuming only 250mW typically at 30 MSPS. Microprocessor compatible data output latches are provided which present valid data to the output bus 1 1/2 clock cycles after the convert command is received. An overflow bit is provided to allow the series connection of two converters to achieve 7 bit resolution.

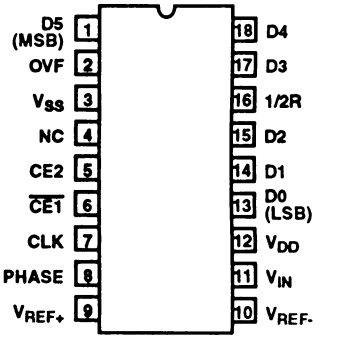
The HI-5701 is available in Commercial and Industrial temperature ranges and is supplied in 18 pin Plastic DIP and SOIC packages.

Ordering Information

PART NUMBER	LINEARITY (DNL)	SAMPLING RATE	TEMPERATURE RANGE	PACKAGE
HI3-5701K-5	0.6 LSB	30MHz (33ns)	0°C to +75°C	18 Pin Plastic DIP
HI9P5701K-5	0.6 LSB	30MHz (33ns)	0°C to +75°C	18 Pin SOIC
HI3-5701B-9	0.6 LSB	30MHz (33ns)	-40°C to +85°C	18 Pin Plastic DIP
HI9P5701B-5	0.6 LSB	30MHz (33ns)	-40°C to +85°C	18 Pin SOIC

Pinout

18 PIN PLASTIC DIP AND SOIC
TOP VIEW



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File Number **2937.1**

HARRIS

HSP45102

September 1991

12-Bit Numerically Controlled Oscillator

Features

- 33MHz, 40MHz Versions
- 32-Bit Frequency Control
- Binary FSK Modulation
- Quadrature Phase Modulation
- Serial Frequency Load
- 12-Bit Sine Output
- Offset Binary Output Format
- 0.009Hz Tuning Resolution at 40MHz
- Spurious Frequency Components < -69dBc
- Fully Static CMOS
- Available in 28 Pin DIP and SOIC
- Low Cost

Applications

- Direct Digital Synthesis
- Modulation — QPSK and FSK

Description

The Harris HSP45102 is Numerically Controlled Oscillator with 32 bit frequency resolution and 12 bit output. With over 69dB of spurious free dynamic range and worst case frequency resolution of 0.009Hz, the NCO12 provides dramatic improvements in accuracy over other frequeny synthesis solutions at a competitive price.

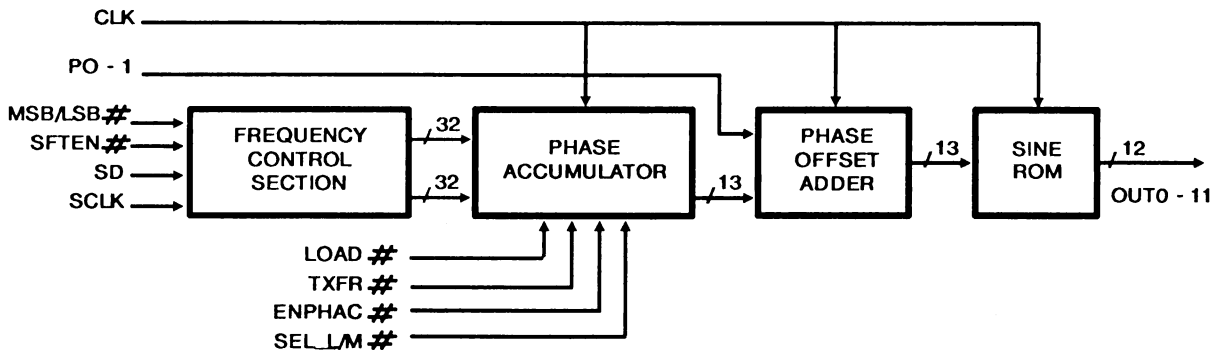
The frequency to be generated is selected from two frequency control words. A single control pin selects which word is used to determine the output frequency. Switching from one frequency to another occurs in one clock cycle, with a 6 clock pipeline delay from the time that the new control word is loaded until the new frequency appears on the output.

Two pins, P0-1, are provided for phase modulation. They are encoded and added to the top two bits of the phase accumulator to offset the phase in 90^{o} increments.

The 13 bit output of the Phase Offset Adder is mapped to the sine wave amplitude via the Sine ROM. The output data format is offset binary to simplify interfacing to D/A converters. Spurious frequency components in the output sinusoid are less than -69dBc.

The NCO12 has applications as a Direct Digital Synthesizer and modulator in low cost digital radios, satellite terminals, and function generators.

Block Diagram



Harris Semiconductor

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File Number 2810.2

HARRIS

HSP45106

May 1991

16 Bit Numerically Controlled Oscillator

Features

- 25.6MHz, 33MHz, 40MHz Versions
- 32-Bit Center and Offset Frequency Control
- 16-Bit Phase Control
- 8 Level PSK Supported Through Three Pin Interface
- Simultaneous 16 Bit Sine and Cosine Outputs
- Output in Two's Complement or Offset Binary
- <0.01Hz Tuning Resolution at 40MHz
- Serial or Parallel Outputs
- Spurious Frequency Components < -90dBc
- 16 Bit Microprocessor Compatible Control Interface
- 85 Pin PGA, 84 Pin PLCC

Applications

- Direct Digital Synthesis
- Quadrature Signal Generation
- Modulation - FM, FSK, PSK (BPSK, QPSK, 8PSK)
- Precision Signal Generation

Description

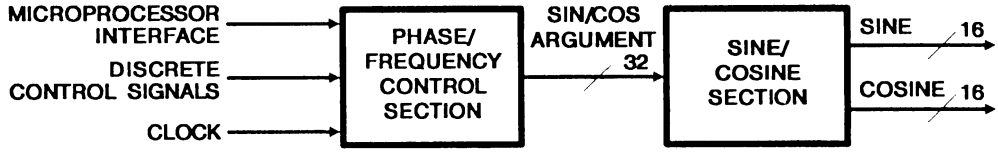
The Harris HSP45106 is a high performance 16-bit quadrature numerically controlled oscillator (NCO16). The NCO16 simplifies applications requiring frequency and phase agility such as frequency-hopped modems, PSK modems, spread spectrum communications, and precision signal generators. As shown in the block diagram, the HSP45106 is divided into a Phase/Frequency Control Section (PFCS) and a Sine/Cosine Section.

The inputs to the Phase/Frequency Control Section consist of a microprocessor interface and individual control lines. The frequency resolution is 32 bits, which provides for resolution of better than 0.01Hz at 40MHz. User programmable center frequency and offset frequency registers give the user the capability to perform phase coherent switching between two sinusoids of different frequencies. Further, a programmable phase control register allows for phase control of better than 0.006°. In applications requiring up to 8-level PSK, three discrete inputs are provided to simplify implementation.

The output of the PFCS is a 32-bit phase which is input to the Sine/Cosine Section for conversion into sinusoidal amplitude. The outputs of the sine/cosine section are two 16-bit quadrature signals. The spurious free dynamic range of this complex vector is greater than 90dBc.

For added flexibility when using the NCO16 in conjunction with DAC's, a choice of either parallel of serial outputs with either two's complement or offset binary encoding is provided. In addition, a synchronization signal is available which signals serial word boundaries.

Block Diagram



Harris Semiconductor

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File Number 2809

HARRIS

HSP43168

November 1991

Dual FIR Filter

Features

- Two Independent 8-Tap FIR Filters Configurable as a Single 16-Tap FIR
- 10 Bit Data & Coefficients
- On-Board Storage for 32 Programmable Coefficient Sets
- Up To: 256 FIR Taps, 16 x 16 2-D Kernels, or 10 x 20 Bit Data and Coefficients
- Programmable Decimation to 16
- Programmable Rounding on Output
- Mixed Mode Arithmetic
- Standard Microprocessor Interface
- 33MHz, 45MHz Versions
- 85-Pin PGA, 84-Pin PLCC Packages

Applications

- Quadrature Filtering
- Correlation
- Image Processing
- Complex Filtering
- PolyPhase Filtering
- Adaptive Filtering

Description

The HSP43168 Dual FIR Filter consists of two independent 8-tap FIR filters. Each filter supports decimation from 1 to 16 and provides on-board storage for 32 sets of coefficients. The Block Diagram shows two FIR cells each fed by a separate coefficient bank and one of two separate inputs. The outputs of the FIR cells are either summed or multiplexed by the MUX/Adder. The compute power in the FIR Cells can be configured to provide quadrature filtering, complex filtering, 2-D convolution, 1-D/2-D correlations, and interpolating/decimating filters.

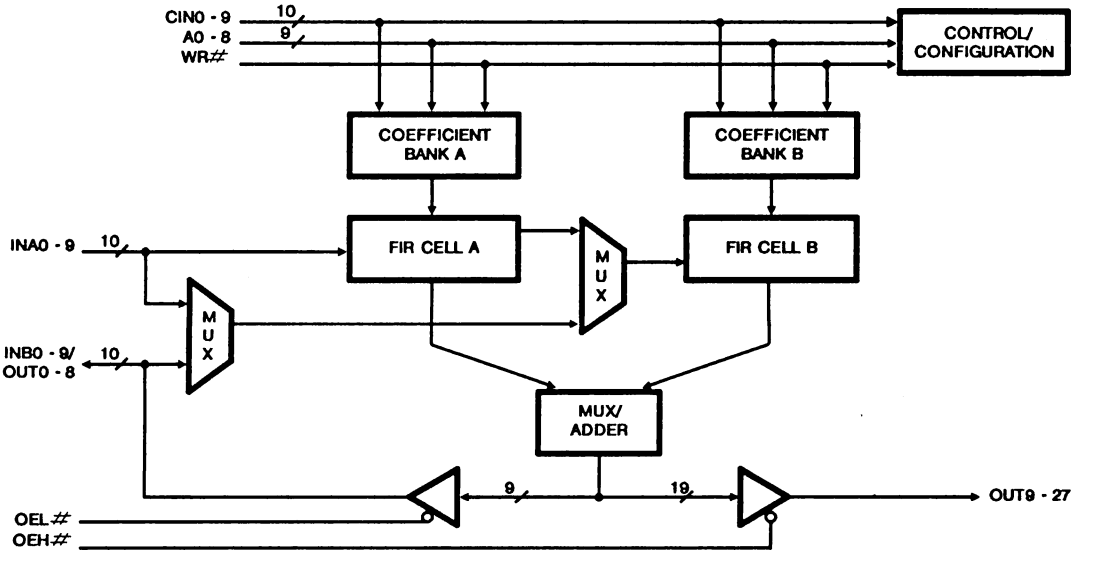
The FIR cells take advantage of symmetry in FIR coefficints by pre-adding data samples prior to multiplication. This allows an 8-tap FIR to be implemented using only 4 multipliers per filter cell. These cells can be configured as either a single 16-tap FIR filter or dual 8-tap FIR filters. Asymmetric filtering is also supported.

Decimation of up to 16 is provided to boost the effective number of filter taps from 2 to 16 times. Further, the decimtion registers provide the delay necessary for fractional data conversion and 2-D filtering with kernels to 16x16.

The flexibility of the Dual is further enhanced by 32 sets of user programmable coefficients. Coefficient selection may be changed asynchronously from clock to clock. The ability to toggle between coefficient sets further simplifies applications such as polyphase or adaptive filtering.

The HSP43168 is a low power fully static design implemented in an advanced CMOS process. The configuration of the device is controlled through a standard microprocessor interface. The Dual FIR Filter is available in 85 pin PGA and 84 pin PLCC packages.

Block Diagram



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File Number 2808.1

Harris Semiconductor

HARRIS

HSP43220

February 1991

Decimating Digital Filter

Features

- Single Chip Narrow Band Filter with up to 96dB Attenuation
- DC to 33MHz Clock Rate
- 16 Bit 2's Complement Input
- 20 Bit Coefficients in FIR
- 24 Bit Extended Precision Output
- Programmable Decimation up to a Maximum of 16,384
- Standard 16 Bit Microprocessor Interface
- Filter Design Software Available DECI•MATE™
- Available in 84 Pin PGA and PLCC

Applications

- Very Narrow Band Filters
- Zoom Spectral Analysis
- Channelized Receivers
- Large Sample Rate Converter
- Instrumentation
- 512 Tap Symmetric FIR filtering

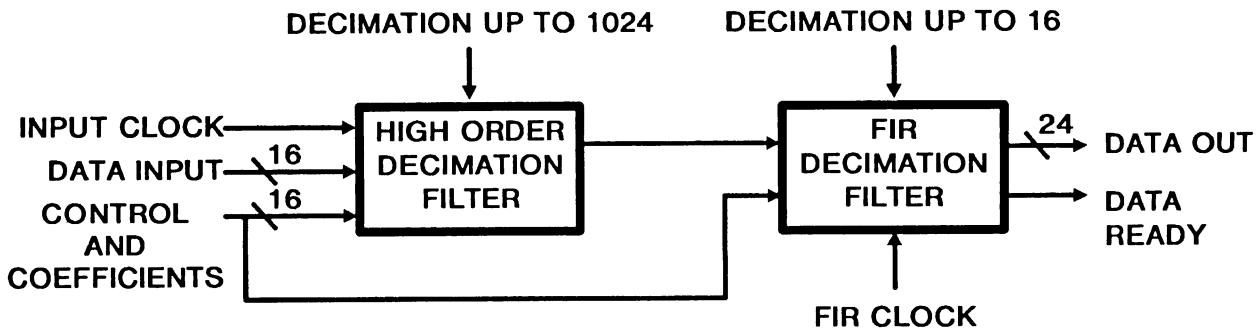
Description

The HSP43220 Decimating Digital Filter is a linear phase low pass decimation filter which is optimized for filtering narrow band signals in a broad spectrum of a signal processing applications. The HSP43220 offers a single chip solution to signal processing application which have historically required several boards of IC's. This reduction in component count results in faster development times as well as reduction of hardware costs.

The HSP43220 is implemented as a two stage filter structure. As seen in the block diagram, the first stage is a high order decimation filter (HDF) which utilizes an efficient decimation (sample rate reduction) technique to obtain decimation up to 1024 through a coarse low-pass filtering process. The HDF provides up to 96 dB aliasing rejection in the signal pass band. The second stage consists of a finite impulse response (FIR) decimation filter structured as a transversal FIR filter with up to 512 symmetric taps which can implement filters with sharp transition regions.The FIR can perform further decimation by up to 16 if required while preserving the 96 dB aliasing attenuation obtained by the HDF. The combined total decimation capability is 16,384.

The HSP43220 accepts 16 bit parallel data in 2's complement format at sampling rates up to 33MSPS. It provides a 16 bit microprocessor compatible interface to simplify the task of programming and three-state outputs to allow the connection of several IC's to a common bus. The HSP43220 also provides the capability to bypass either the HDF or the FIR for additional flexibility.

Block Diagram



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HARRIS

HSP45116

Numerically Controlled Oscillator/Modulator

May 1991

Features

- NCO and CMAC on One Chip
- 15MHz, 25.6MHz, 33MHz Versions
- 32-bit Frequency Control
- 16-bit Phase Modulation
- 16-bit CMAC
- 0.008Hz Tuning Resolution at 33MHz
- Spurious Frequency Components < -90dBc
- Fully Static CMOS
- 145 Pin PGA

Applications

- Frequency Synthesis
- Modulation - AM, FM, PSK, FSK, QAM
- Demodulation, PLL
- Phase Shifter
- Fast Fourier Transforms (FFT)
- Polar to Cartesian Conversions

Description

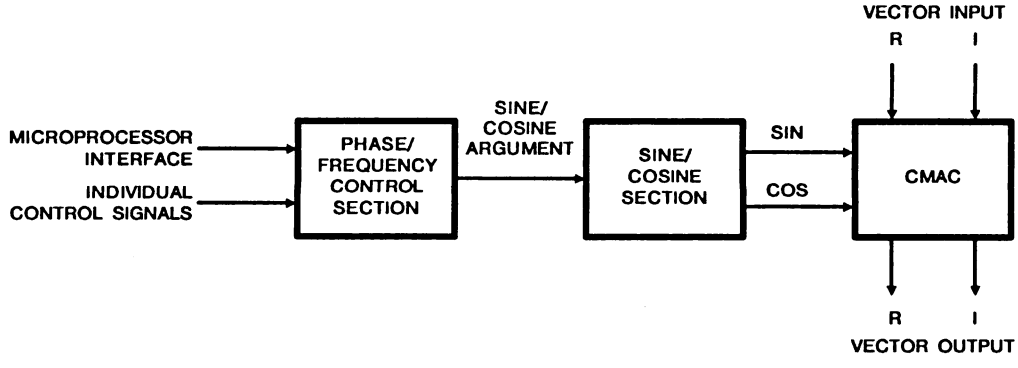
The Harris HSP45116 combines a high performance quadrature numerically controlled oscillator (NCO) and a high speed 16-bit Complex Multiplier/Accumulator (CMAC) on a single IC. This combination of functions allows a complex vector to be multiplied by the internally generated (cos, sin) vector for quadrature modulation and demodulation. As shown in the block diagram, the HSP45116 is divided into three main sections. The Phase/Frequency Control Section (PFCS) and the Sine/Cosine Section together form a complex NCO. The CMAC multiplies the output of the Sine/Cosine Section with an external complex vector.

The inputs to the Phase/Frequency Control Section consist of a microprocessor interface and individual control lines. The phase resolution of the PFCS is 32 bits, which results in frequency resolution better than 0.008Hz at 33MHz. The output of the PFCS is the argument of the sine and cosine. The spurious free dynamic range of the complex sinusoid is greater than 90dBc.

The output vector from the Sine/Cosine Section is one of the inputs to the Complex Multiplier/Accumulator. The CMAC multiplies this (cos, sin) vector by an external complex vector and can accumulate the result. The resulting complex vectors are available through two 20-bit output ports which maintain the 90dB spectral purity. This result can be accumulated internally to implement an accumulate and dump filter.

A quadrature down converter can be implemented by loading a center frequency into the Phase/Frequency Control Section. The signal to be downconverted is the Vector Input of the CMAC, which multiplies the data by the rotating vector from the Sine/Cosine Section. The resulting complex output is the down converted signal.

Block Diagram



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File Number 2485.2

HARRIS

HSP45256

ADVANCE INFORMATION

May 1991

Binary Correlator

Harris Semiconductor

Features

- Reconfigurable 256 Stage Binary Correlator
- 1-Bit Reference x 1, 2, 4, 8 Bit Data
- Configurable as 2 Separate Correlators
- Separate Data, Control and Reference Inputs
- Standard Microprocessor Interface
- Configurable for 1-D and 2-D Correlation
- Double Buffered Mask and Reference Register
- Programmable Output Delay
- Offset Register
- 85 Pin PGA, 84 Pin PLCC
- 20MHz, 25.6MHz, 33MHz Versions

Applications

- Radar/Sonar Applications
- Spread Spectrum Communications
- Synchronization
- Pattern/Character Recognition
- Error Correction Coding

Description

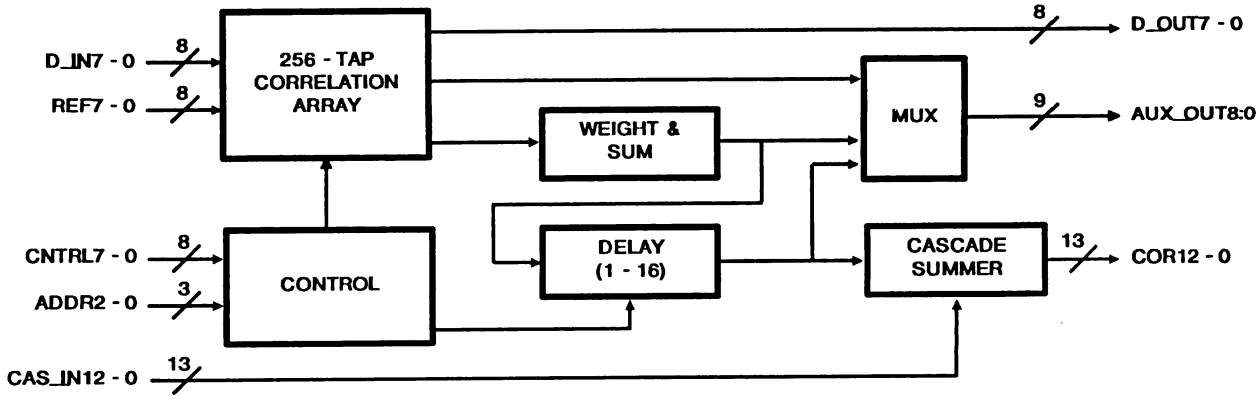
The HSP45256 is a low cost, high speed, 256-tap binary correlator. The correlator taps may be configured to perform 1-D and 2-D correlations of selectable precision and window size. Because of this flexibility, the Binary Correlator is ideally suited for 1-D applications, such as radar, as well as 2-D applications, such as character recognition. In addition, multiple HSP45256's are easily cascaded if extended precision and/or window size is required.

The heart of the Binary Correlator consists of a set of eight 32-tap stages. These eight filter stages may be internally cascaded to process 1, 2, 4, or 8-bit input data with a 1-bit reference. Depending on the precision of the input data, the size of the correlation window can vary from 8 x 32 to 1 x 256. The HSP45256 can also be configured for operation as two separate correlators with data precision of 1, 2, or 4 bits and window sizes from 4 x 32 to 1 x 128. A mask register is provided which allows the user to prevent any subset of the 256 correlation taps from contributing to the correlation score.

The output of the correlation array feeds the weight and sum logic where a user selectable bit weighting is applied to determine the correlation score. For added flexibility, an offset register is provided which allows the user to add a programmed value to the correlation score. This result is then passed through a user programmable delay stage to the cascade summer. The delay stage simplifies the cascading of multiple correlators by compensating for the latency of previous stages.

The Binary Correlator is configured by writing a set of control registers via a standard microprocessor interface. To simplify operation, both the control and reference registers are double buffered. This allows the user to load new mask and reference data while the current correlation is being completed.

Block Diagram



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File Number 2814

When contacting suppliers, say you saw it in IC MASTER

HARRIS SEMICONDUCTOR

HBC2500

3μm BIMOS-E Device Analog / Digital Library Features

January 1992

Features

- Cost-effective 3 L_{eff} micron BICMOS technology integrates up to 2000 gates and 100 op amps
- Typical performance of 5 ns NAND gates, 22 ns D-Flip-flops, 1- 20 MHz UGBW 0p-amps with 1-5mV offsets, 250 ns comparator delays
- Operates over the voltage range of 3 -15 volts
- Comprehensive Analog/Digital Cell and Device Library containing 51 digital cells, 49 analog cells and 20 device types supported on Harris FASTRACK. There are 93 additional cells in development.
- Up to 800 mA or more output drive capability (limited by metal width)
- Selective use of Vertical PNP and NPN (captive collector) transistors allows broadband analog operation
- A sampled-data cell library and toolset is in development and is currently used by Harris designers
- Silicon functionality is guaranteed to match simulation results or Harris will pay for the iteration

Description

The Harris HBC2500 is a mixed-signal (analog and digital) BICMOS library supported on the Harris FASTRACK Design System. The interface to Harris is such that the end user can perform the electrical design and simulation tasks at his location, subsequently passing the design database to Harris for Layout and Fabrication. Both cell-based and device-level designs are supported. Cells are modeled for a variety of simulators, allowing flexibility in the approach to design and verification.

Applications

- Signal Processing and Control for Automotive, Consumer, Industrial and Military Systems
- Stepper motor control applications
- Power supply regulator and control
- Hybrid Replacement
- Obsolete parts replacement
- Consolidation of System "Glue" Functions for size and cost reduction

Design System Support:

- The HBC2500 library is supported on Harris FASTRACK, a Cadence- Analog Artist™ based design system which is used worldwide.
- The Harris FASTRACK toolset supports customer use of digital, continuous time analog, and mixed-signal design methodologies, allowing use of existing cells and device-level designs through the use of Transistor, Resistor and Capacitor compilers.
- SPICE macromodels allow full-chip simulation of complex mixed signal functions using VerilogSpice
- FASTRACK Supports multiple simulators:
  - Verilog (Digital)
  - Spice (Analog)
  - VerilogSpice (Mixed Analog/Digital)
- Testing supported by Teradyne, LTX, Trillium and HP equipment

Physical Design Tools

- Harris Backend Tools ensures an error-free layout implementation which include:
  - Transistor, Resistor, and Capacitor layout compilers
  - Automatic Place and Route tools speed generation of chip layouts
  - Full DRC and LVS checking tools

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HARRIS SEMICONDUCTOR

HDI1000

EBHF Parametric Device Library

January 1992

Features

- **High Frequency (EBHF) Process**
  - **Dielectric Isolation Significantly Reduces Parasitic Capacitance**
  - **40 Volt BV_{CEO}**
  - **F_T =0.5GHz**
- **Wide Range of Process Options Allowing Design Flexibility**
  - **Vertical NPN Bipolar Transistors**
  - **Vertical PNP Bipolar Transistors**
  - **Various Diffused Resistors**
  - **Laser Trimmable NiCr Resistors**
  - **MOS Capacitors**
  - **PJFETs**
  - **Surface Zener Diodes**

Applications

- **Bipolar IC's for Analog Signal Processing and Control**

Description

The Harris EBHF Process is a Dielectrically Isolated bipolar process which operates at a nominal 40V supply voltage. The HARRIS FASTRACK™ Design Toolset contains CAE tools which allow analog designers to efficiently design analog integrated circuits regardless of previous IC design experience. The design toolset uses a parametric device library which contains six NPN and six PNP device types. The designer uses proprietary Harris CAE tools to automate device level design and layout. For each transistor in the HDI1000 parametric device library, the device dimensions are fully adjustable. This data sheet provides device characteristics of the minimum sized devices in the library. All devices may be made larger to provide for higher currents, lower base resistance (R_B), or lower collector resistance (R_C). FASTRACK automatically calculates model parameter values for devices which differ from the minimum size.

Harris Semiconductor

TABLE 1. NOMINAL DEVICE CHARACTERISTICS

PARAMETER	NPN	PNP	PJFET	SURFACE ZENER	UNITS
BV_{CEO}	40	40	-	-	V
BV_{DSS}	-	-	35	-	V
H_{FE}	200	130	-	-	-
F_T	0.5*	0.5*	-	-	GHz
V_P	-	-	1.5	-	V
V_A	130	75	-	-	V
V_Z	-	-	-	5.2	V

* EBHN4, EBHP4 peak F_T at V_{CE} = 5V

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File Number **2769**

HARRIS SEMICONDUCTOR

HDI2000

VHF Parametric Device Library

January 1992

Features

- **Very High Frequency (VHF) Process**
  - **Dielectric Isolation Significantly Reduces Parasitic Capacitance**
  - **Double Level Metal**
  - **20 Volt BV_{CEO}**
  - **F_T =1.0GHz**
- **Wide Range of Process Options Allowing Design Flexibility**
  - **Vertical NPN Bipolar Transistors**
  - **Vertical PNP Bipolar Transistors**
  - **Various Diffused Resistors**
  - **Laser Trimmable NiCr Resistors**
  - **MOS Capacitors**
  - **PJFETs**
  - **Buried and Surface Zener Diodes**

Applications

- **Bipolar IC's for Analog Signal Processing and Control**

Description

The Harris VHF Process is a Dielectrically Isolated bipolar process which operates at a nominal 20V supply voltage. The HARRIS FASTRACK™ Design Toolset contains CAE tools which allow analog designers to efficiently design analog integrated circuits regardless of previous IC design experience. The design toolset uses a parametric device library which contains four NPN and four PNP device types. The designer uses proprietary Harris CAE tools to automate device level design and layout. For each transistor in the HDI2000 parametric device library, the device dimensions are fully adjustable. This data sheet provides device characteristics of the minimum sized devices in the library. All devices may be made larger to provide for higher currents, lower base resistance (R_B), or lower collector resistance (R_C). FASTRACK automatically calculates model parameter values for devices which differ from the minimum size.

Harris Semiconductor

TABLE 1. NOMINAL DEVICE CHARACTERISTICS

PARAMETER	NPN	PNP	PJFET	BURIED ZENER	SURFACE ZENER	UNITS
BV_{CEO}	20	20	-	-	-	V
BV_{DSS}	-	-	20	-	-	V
H_{FE}	150	120	-	-	-	-
F_T	1.0	0.9	-	-	-	GHz
V_P	-	-	1.0	-	-	V
V_A	90	24	-	-	-	V
V_Z	-	-	-	5.4	5.2	V

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File Number **2770**

HARRIS SEMICONDUCTOR

HDI3000

UHF Parametric Device Library

January 1992

Features

- **High Frequency (UHF) Process**
  - **Dielectric Isolation With Wafer Bonding and Trench Technology Significantly Reduces Parasitic Capacitance**
  - **12 Volt BV_{CEO}**
  - **F_T = 8GHz (NPN) and 4GHz (PNP)**
- **Wide Range of Process Options Allowing Design Flexibility**
  - **Vertical NPN Bipolar Transistors**
  - **Vertical PNP Bipolar Transistors**
  - **Various Diffused Resistors**
  - **NiCr Resistors**
  - **Poly Resistors**
  - **MOS Capacitors**
  - **Buried Zener Diodes**

Applications

- **Bipolar IC's for Analog Signal Processing and Control**

Description

The Harris UHF Process is a Dielectrically Isolated bipolar process which operates at a nominal 12V supply voltage. The HARRIS FASTRACK™ Design Toolset contains CAE tools which allow analog designers to efficiently design analog integrated circuits regardless of previous IC design experience. The design toolset uses a parametric device library which contains four NPN and four PNP device types. The designer uses proprietary Harris CAE tools to automate device level design and layout. For each transistor in the HDI3000 parametric device library, the device dimensions are fully adjustable. This data sheet provides device characteristics of the minimum sized devices in the library. All devices may be made larger to provide for higher currents, lower base resistance (R_B), or lower collector resistance (R_C). FASTRACK automatically calculates model parameter values for devices which differ from the minimum size.

Harris Semiconductor

TABLE 1. NOMINAL DEVICE CHARACTERISTICS

PARAMETER	NPN	PNP	NJFET	BURIED ZENER	UNITS
BV_{CEO}	12	12	-	-	V
H_{FE}	150	100	-	-	-
F_T	8	4	-	-	GHz
V_A	60	30	-	-	V
V_Z	-	-	-	5.4	V

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File Number **2769**

HARRIS SEMICONDUCTOR

HTA1000

EBHF Tile Array

January 1992

Features

- **Supported on the Harris FASTRACK™ Design System**
- **High Frequency Dielectrically Isolated 40 Volt Complementary Bipolar Process**
- **High Performance Cell Library**
- **Cell Macromodels Available for Fast Simulation**
- **Transistor Level Design Also Supported**
- **F_T =0. 5GHz**
- **User Definable NiCr Resistors**
- **Devices Include PJFET's, Surface Zeners, and MOS Capacitors**
- **Personalized by Two Metal Interconnect, Via, and One NiCr Resistor Level**
- **Lower NRE Charges Compared to Full Custom**
- **Minimum Turnaround Times for First Silicon**

Applications

- **General Analog System Implementation**
- **Consolidation of Discrete Components and Analog ICs**
- **Reduce Size and Cost, Increase Reliability and Performance**
- **Quick-turn, Low Cost, IC Design Verification**
- **Design Feasibility Units or System Demonstration Units**
- **Development of Production Units for Low Volume Systems**

Overview

The Harris HTA1000 tile array provides the analog system designer with a fast turn, low cost tile array methodology for the design of high performance, high speed analog circuits and systems. The HTA1000 is supported on the Harris FASTRACK design system, and is implemented using the Harris dielectrically isolated EBHF production process. Simulation capability on FASTRACK is available to the designer, including a combination of deterministic and statistical analysis modes. These modes provide the designer with a statistical analysis of circuit performance and a method for detailed investigations of parametric yield.

The HTA1000 tile array incorporates an extensive library of high performance analog cells. This library includes op amps, comparators, sample/holds, references, and differential video circuits. Each cell has a companion macromodel which, when substituted, will significantly reduce circuit simulation time for preliminary system level analysis. Interconnect of the cells is implemented by personalizing two levels of metal and custom and via design of NiCr resistors. Utilizing the electrical and physical design tools of FASTRACK, transistor level design is supported using portions of the array not dedicated to implement tile array cells. Final circuit simulations may include cells represented at the device level and/or macromodel level in order to obtain any desired combination of simulation speed and accuracy.

Base wafers are processed up to the resistor and interconnect levels and are then inventoried at the factory, providing rapid silicon turn-around upon receipt of a customer's design.

Table 1. Cell Family

Quantity	Cell Type	Description/Application
8	General Purpose OP-AMP	Stabilized for nominal closed loop gain of 1, 2, 5 or 10 with choice of bipolar or JFET inputs.
6	High Speed OP-AMP	Stabilized for nominal closed loop gain of 1, 2, or 5 with choice of bipolar or JFET inputs.
1	Single Supply OP-AMP	Wide single supply operation stabilized for nominal closed loop gain of 1.
4	Voltage Comparators	General purpose or low power voltage comparators with choice of bipolar or JFET inputs. Output logic level is set by user.
2	Voltage References	5.0 and 10.0 Volt references.
2	Sample & Hold Devices	Choice of bipolar or JFET inputs. Self contained S/H capacitor.
2	Video Amplifiers	Gain of 10X or 40X. Differential circuits intended for high speed applications.
1	Mixer	Differential circuit intended for high speed applications.
2	Multipliers	Four quadrant analog multiplier. Offered with and without an internal op amp.

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HARRIS SEMICONDUCTOR

HTA2000

VHF Tile Array

January 1992

Harris Semiconductor

Features

- **Supported on Harris FASTRACK™ Design System**
- **Very High Frequency (VHF) Dielectrically Isolated 20 Volt Complementary Bipolar Process**
- **High Performance C. ' Library**
- **Cell Macromodels Available for Fast Simulation**
- **Transistor Level Design Also Supported**
- **NPN and PNP F_T's of 1.2 and 1.0 GHz, Respectively.**
- **User Definable NiCr Resistors**
- **Devices Include PJFET's, Buried Zeners, and MOS Capacitors**
- **Personalized by Two Metal Interconnect and One NiCr Resistor Level**
- **Reduced NRE Charges Compared to Full Custom**
- **Minimum Turnaround Times for First Silicon**

Applications

- **General Analog System Implementation**
- **Consolidation of Discrete Components and Analog IC's**
- **Reduce Size and Cost, Increase Reliability and Performance**
- **Quick-turn, Low Cost, IC Design Verification**
- **Design Feasibility Units or System Demonstration Units**
- **Development of Production Units for Low Volume Systems**

Overview

The Harris HTA2000 tile array provides the analog system designer with a fast turn, low cost tile array methodology for the design of high performance, high speed analog circuits and systems. The HTA2000 is supported on the Harris FASTRACK design system, and is implemented using the Harris dielectrically isolated VHF production process. Simulation capability on FASTRACK is available to the designer, including a combination of deterministic and statistical analysis modes. These modes provide the designer with a statistical analysis of circuit performance capability which and a detailed investigation of parametric yield.

The HTA2000 tile array incorporates an extensive library of high performance analog cells. This library includes op amps, comparators, sample/holds, buffers, references, and differential video circuits. Each cell has a companion macromodel which, when substituted, will significantly reduce circuit simulation time for preliminary system level analysis. Interconnect of the cells is implemented by personalizing two levels of interconnect and custom design of NiCr resistors. Utilizing the electrical and physical design tools of FASTRACK System, transistor level design is supported using portions of the array not dedicated to implement tile array cells. Final circuit simulations may include cells represented at the device level and/or macromodel level in order to obtain any desired combination of simulation speed and accuracy.

Base wafers are processed up to the resistor and interconnect levels and then inventoried at the factory, providing rapid silicon turn-around upon receipt of a customer's design.

Table 1. Cell Family

Quantity	Cell Type	Description/Application
8	Operational Amplifiers	Stabilized for nominal closed loop gain of 1 ,2, 5 or 10 with choice of bipolar or JFET inputs. Outputs short circ uit protected.
4	Voltage Comparators	General purpose or low power voltage comparators with choice of bipolar or JFET inputs. Output logic level is set by user.
3	Voltage References	5.0 Volt, 2.5 Volt and 1.5 Volt references
2	High Speed Unity Gain Buffers	Choice of bipolar or JFET inputs.
2	Sample & Hold Devices	Choice of bipolar or JFET inputs. Self contained S/H capacitor.
2	Video Amplifiers	Gain of 10X or 40X. Differential circuits intended for video applications.
1	Mixer	Differential circuit intended for video applications.
2	Multipliers	Offered with and without internal op amp. Differential circuits intended for video applications.

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HARRIS SEMICONDUCTOR

HTA3000

UHF Tile Array

January 1992

Features

- **Supported on Harris Bipolar Analog FASTRACK™ Design System**
- **Ultra High Frequency Dielectrically Isolated 10 Volt Complementary Bipolar Process**
- **High Performance Cell Library**
- **Cell Macromodels Available for Fast Simulation**
- **Transistor Level Design Also Supported**
- **F_T = 8GHz (NPN), 4GHz (PNP)**
- **User Definable NiCr Resistors**
- **Devices Include NJFET's, Buried Zeners, MOS Capacitors and Diffused Resistors**
- **Personalized by Two Metal Interconnect and One NiCr Resistor Level**
- **Reduced NRE Charges Compared to Full Custom**
- **Minimum Turnaround Times for First Silicon**

Applications

- **High Speed Analog System Implementation**
- **Consolidation of Discrete Components and Analog IC's**
- **Reduce Size and Cost, Increase Reliability and Performance**
- **Quick-turn, Low Cost, IC Design Verification**
- **Design Feasibility Units or System Demonstration Units**
- **Development of Production Units for Low Volume Systems**

Overview

The Harris HTA3000 tile array provides the analog system designer with a fast turn, low cost tile array methodology for the design of high performance, high speed analog circuits and systems. The HTA3000 is supported on the Harris Bipolar Analog FASTRACK Design System, and is implemented using the Harris dielectrically isolated UHF production process. Simulation capability on FASTRACK is available to the designer, including a combination of deterministic and statistical analysis modes. These modes provide the designer with a statistical analysis of circuit performance and a method for detailed investigations of parametric yield.

The HTA3000 Tile Array incorporates an extensive library of high performance analog cells. This library includes op amps, comparators, sample/holds, references, and differential video circuits. Each cell has a companion macromodel which, when substituted, will significantly reduce circuit simulation time for preliminary system level analysis. Interconnect of the cells is implemented by personalizing two levels of metal and custom design of NiCr resistors. Utilizing the electrical and physical design tools of FASTRACK, transistor level design is supported using portions of the array not dedicated to implement tile array cells. Final circuit simulations may include cells represented at the device level and/or macromodel level in order to obtain any desired combination of simulation speed and accuracy.

Base wafers are processed up to the resistor and interconnect levels and then inventoried at the factory, providing rapid silicon turn-around upon receipt of a customer's design.

Harris Semiconductor

Table 1. Cell Family

Quantity	Cell Type	Description/Application
3	General Purpose OP-AMP	Stabilized for nominal closed loop gain of 1,2 or 5. High speed capability with moderate power and precision.
1	Current Feedback Amplifier	High speed, wide band, unity gain stable current feedback amplifier.
1	Voltage Comparator	High speed voltage comparator with ouput logic level set by user.
2	Voltage References	2.0 and 5.0 Volt references.
1	Sample & Hold Device	High speed sample-hold with self contained S/H capacitor.
2	Video Amplifiers	Gain of 10X or 40X. Differential circuits intended for high speed applications.
1	Mixer	Differential circuit intended for high speed applications.
1	Multiplier	Four quadrant analog multiplier cell with current output intended for RF applications.

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HARRIS

HS-6617RH

Radiation Hardened 2K x 8 CMOS PROM

July 1990

Harris Semiconductor

Features

- Total Dose ..... 1×10^5 RAD (Si)
- Latch-Up Free ..... $>1 \times 10^{12}$ RAD (Si)/s
- Field Programmable
- Functionally Equivalent to HM-6617
- Pin Compatible with Intel 2716
- Low Standby Power ..... 550µW Max.
- Low Operating Power ..... 137.5mW/MHz Max.
- Fast Access Time..... 100ns Max.
- TTL Compatible Inputs/Outputs
- Synchronous Operation
- On Chip Address Latches
- Three-State Outputs
- Nicrome Fuse Links
- Easy Microprocessor Interfacing
- Military Temperature Range.....-55°C to +125°C

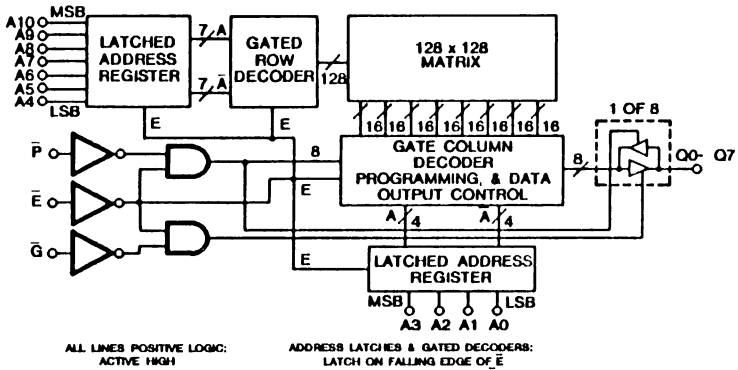
Description

The Harris HS-6617RH is a radiation hardened 16K CMOS PROM, organized in a 2K word by 8-bit format. The chip is manufactured using a radiation hardened CMOS process, and is designed to be functionally equivalent to the HM-6617. Synchronous circuit design techniques combine with CMOS processing to give this device high speed performance with very low power dissipation.

On chip address latches are provided, allowing easy interfacing with recent generation microprocessors that use multiplexed address/data bus structure, such as the HS-80C85RH or HS-80C86RH. The output enable control ($\overline{G}$) simplifies microprocessor system interfacing by allowing output data bus control, in addition to, the chip enable control. Synchronous operation of the HS-6617RH is ideal for high speed pipelined architecture systems and also in synchronous logic replacement functions.

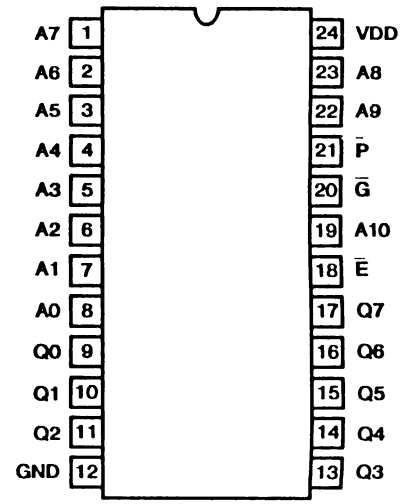
Applications for the HS-6617RH CMOS PROM include low power microprocessor based instrumentation and communications systems, remote data acquisition and processing systems, processor control store, and synchronous logic replacement. A high reliabiity version is available for satellite and other critical applications. Contact your nearest Harris representative.

Functional Diagram



Pinouts

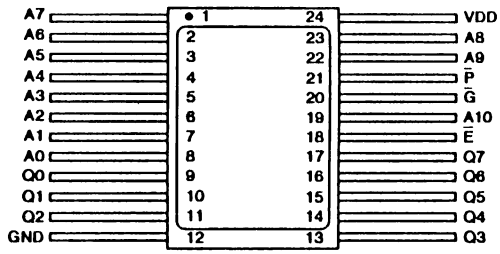
24 PIN BRAZE SEAL DIP
TOP VIEW



PIN NAMES

A	Address Input	P̄	Program Enable (P̄ Hardwired to VDD, except during programming)
Q	Data Output		
Ē	Chip Enable		
Ḡ	Output Enable		

24 PIN FLATPACK CARRIER
TOP VIEW



CAUTION: These devices are sensitive to electrostatic discharge. Proper I.C. handling procedures should be followed.

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HARRIS HS-65758RH

ADVANCED INFORMATION

May 1991

Radiation Hardened 256K Bit SOI SRAM

Features

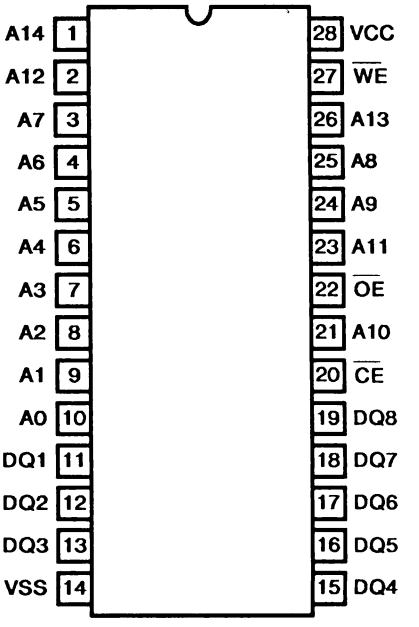
- 0.8μm Radiation Hardened SOI CMOS
  - Total Dose ..... 1×10^6 RADs
  - Data Upset ..... 1×10^{11} RAD/Sec
  - Latch Up Free SOI Process
  - SEU Error Rate ..... $< 1 \times 10^{-10}$ Errors/Bit Day
- Available in 3 Organizations
  - 256K x 1
  - 32K x 8
  - 64K x 4
- Fast Access Time < 25ns Over Voltage, Temperature and Radiation
- Single 5V Power Supply
- Low Power Consumption
  - IDDSB < 500μA Pre RAD
  - IDDSB < 2mA Post 1MRAD
  - IDDOP 110mA (x 1, 40MHz)
  - IDDOP 190mA (x 8, 40MHZ)
- Fully Static 6T Memory Cell

Description

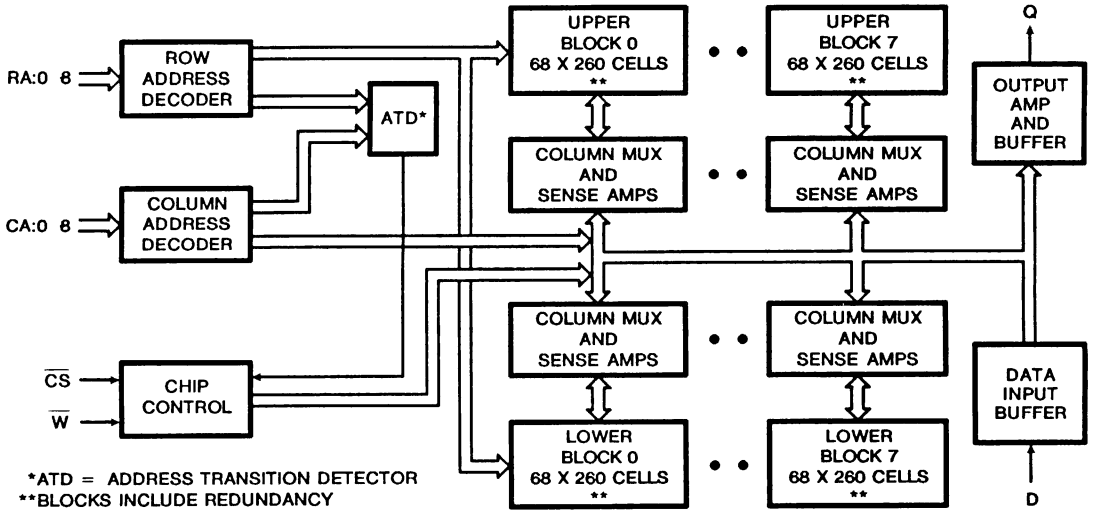
The HS-65758RH is an asynchronous, fully static RAM fabricated with the Harris SIMOX (Silicon Isolated by Implanted Oxygen) radiation hardened process. The use of this process provides excellent total dose, dose rate and single event immunity. As with any oxide isolated circuits, the HS-65758RH will not latch-up under any conditions. This high speed SRAM is available in 256K x 1, 64K x 4 and 32K x 8 organizations.

Pinout

32K x 8 SRAM
TOP VIEW



Functional Diagram



*ATD = ADDRESS TRANSITION DETECTOR
**BLOCKS INCLUDE REDUNDANCY

Harris Semiconductor

CAUTION: Electronic devices are sensitive to electrostatic discharge. Proper I.C. handling procedures should be followed.
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File Number 2860

HS-65643RH

Radiation Hardened 64K x 1 SOS CMOS Static RAM

June 1991

Harris Semiconductor

Features

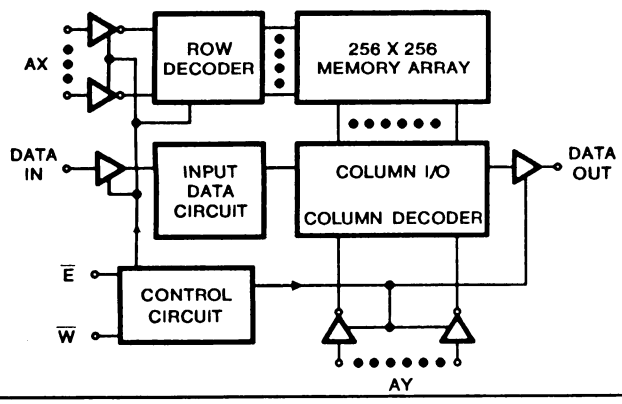
- 1.2 Micron Radiation Hardened SOS CMOS
  - Total Dose ..... 3×10^5 RAD (Si)
  - Transient Upset .....$>1 \times 10^{11}$ RAD (Si)/s
  - Single Event Upset .. $< 1 \times 10^{-12}$ Errors/bit-day
- Latch-up Free
- LET Threshold ..... >250 Mev/mg/cm^2
- Low Standby Supply Current ..... 10mA (Max)
- Low Operating Supply Current..... 35mA (Max)
- Fast Access Time ..... 50ns (Max)
  35ns (Typ)
- High Output Drive Capability.....±8mA
- Gated Input Buffers
- Six Transistor Memory Cell
- Fully Static Design
- Aynchronous Operation
- CMOS Inputs
- 5V Single Power Supply
- Military Temperature Range ....-55°C to +125°C

Description

The Harris HS-65643RH is a fully asynchronous 64K x 1 radiation hardened static RAM. This RAM is fabricated using the Harris 1.2 micron silicon-on-sapphire CMOS technology. This technology gives exceptional hardness to all types of radiation, including neutron fluence, total ionizing dose, high intensity ionizing dose rates, and cosmic rays.

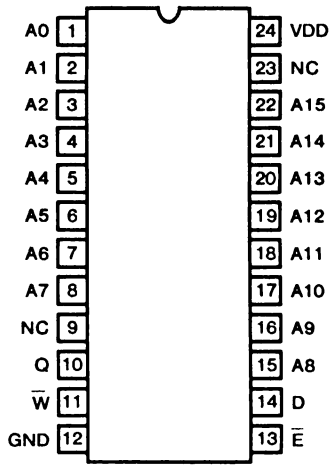
Low power operation is provided by a fully static design. Low standby power can be achieved without pull-up resistors, due to the gated input buffer design.

Functional Diagram

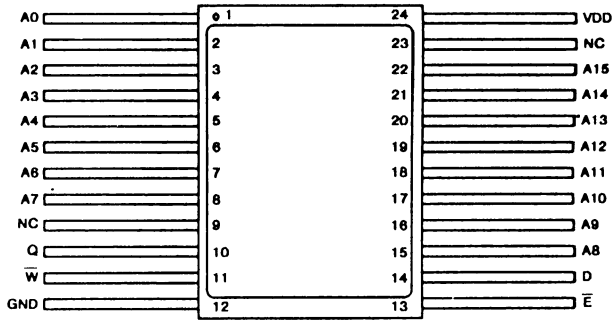


Pinouts

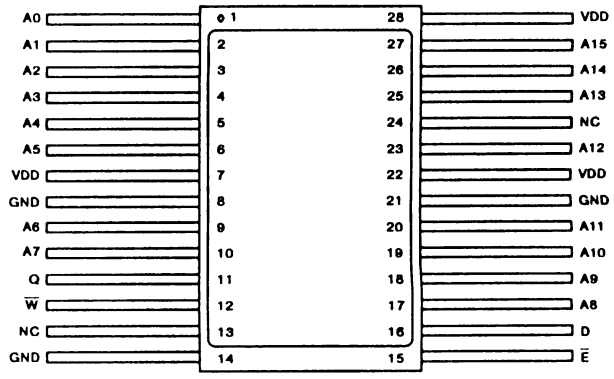
24 PIN CERAMIC DIP
TOP VIEW



24 PJN FLATPACK
TOP VIEW



28 PIN FLATPACK
TOP VIEW



CAUTION: These devices are sensitive to electrostatic discharge. Proper I.C. handling procedures should be followed.

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File Number **2794.1**

HARRIS HS-65647RH

Radiation Hardened 8K x 8 SOS CMOS Static RAM

August 1991

Features

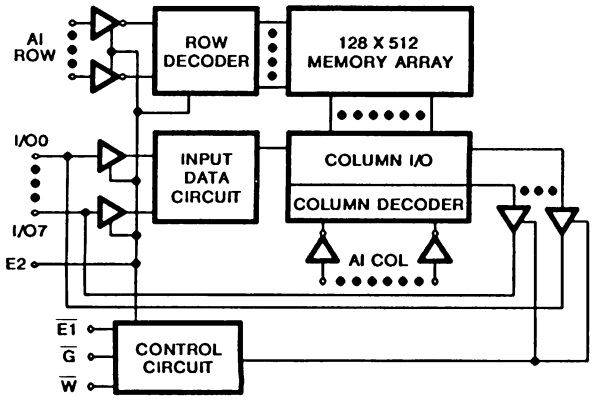
- 1.2 Micron Radiation Hardened SOS CMOS
  - Total Dose ..... 3×10^5 RAD (Si)
  - Transient Upset ..... 1×10^{11} RAD (Si)/s
  - Single Event Upset ..... 1×10^{-12} Errors/bit-day
- Latch-up Free
- LET Threshold ..... >250 MeV/mg/cm^2
- Low Standby Supply Current ..... 10mA (Max)
- Low Operating Supply Current 100mA (2MHz)
- Fast Access Time ..... 50ns (Max) 35ns (Typ)
- High Output Drive Capability
- Gated Input Buffers (Gated by E2)
- Six Transistor Memory Cell
- Fully Static Design
- Aynchronous Operation
- CMOS Inputs
- 5V Single Power Supply
- Standard JEDEC DIP Pinout
- Military Temperature Range ..... -55°C to +125°C

Description

The Harris HS-65647RH is a fully asynchronous 8K x 8 radiation hardened static RAM. This RAM is fabricated using the Harris 1.2 micron silicon-on-sapphire CMOS technology. This technology gives exceptional hardness to all types of radiation, including neutron fluence, total ionizing dose, high intensity ionizing dose rates, and cosmic rays.

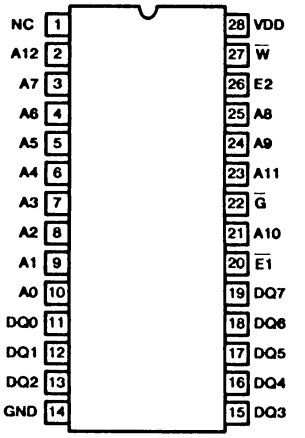
Low power operation is provided by a fully static design. Low standby power can be achieved without pull-up resistors, due to the gated input buffer design.

Functional Diagram

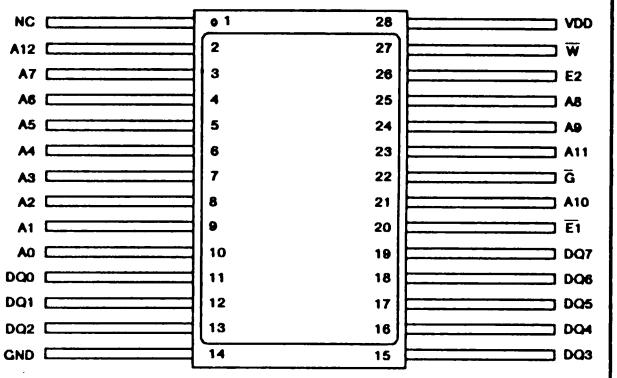


Pinouts

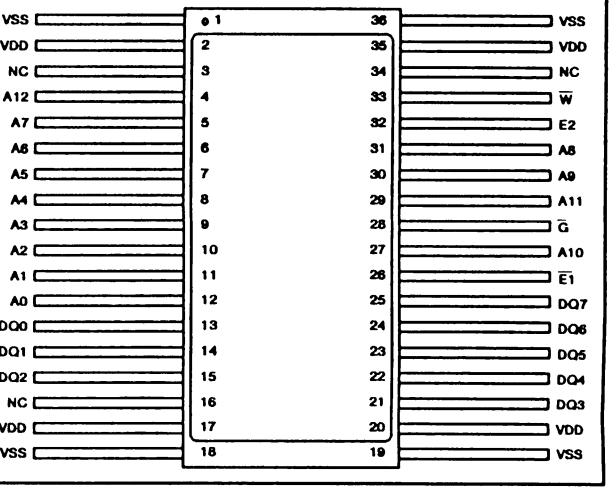
28 PIN CERAMIC DIP
TOP VIEW



28 PIN FLATPACK
TOP VIEW



36 PIN FLATPACK
TOP VIEW



Harris Semiconductor

CAUTION: These devices are sensitive to electrostatic discharge. Proper I.C. handling procedures should be followed.

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File Number 2928

HARRIS HS-26C31RH

PRELIMINARY

September 1991

Radiation Hardened CMOS Quad Differential Line Driver

Features

- Radiation Hardened CMOS
  - Total Dose ..... $1x10^6$ RAD(Si)
  - Transient Upset .. > $1x10^9$ RAD/Sec (20nS Pulse)
  - Latchup Free
- EIA RS-422 Compatible Outputs
- TTL/CMOS Compatible Inputs
- High Impedance Outputs when Disabled or Powered Down
- Low Power Dissipation .....2.75mW Standby (Max)
- Single 5V Supply
- Full -55° to +125° Military Temp. Range

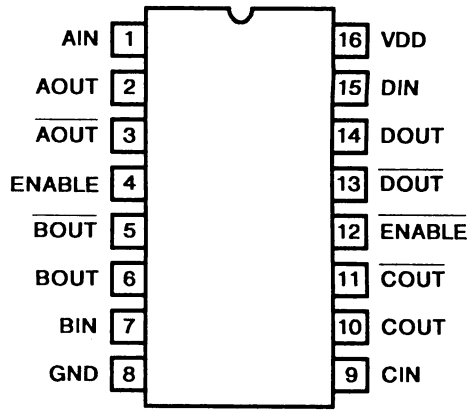
Description

The Harris HS-26C31RH is a quad differential line driver designed for digital data transmission over balanced lines and meets the requirements of EIA standard RS-422. Radiation hardened CMOS processing assures low power consumption, high speed, and reliable operation in the most severe radiation environments.

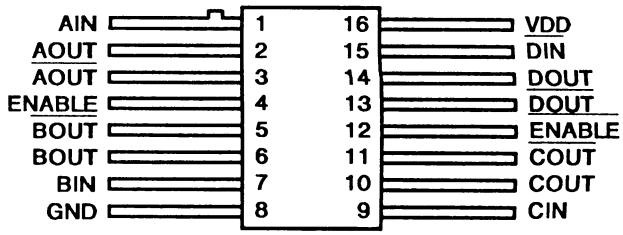
The HS-26C31RH accepts TTL or CMOS input signals and converts them to RS-422 compatible outputs. This circuit uses special outputs that enable the drivers to power down without loading down the bus. Enable and disable pins allow several devices to be connected to the same data source and addressed independantly.

Pinouts

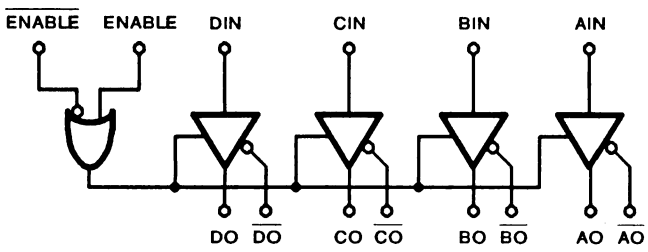
16 PIN CERAMIC DIP
TOP VIEW



16 PIN FLATPACK
TOP VIEW



Logic Diagram



TRUTH TABLE

ENABLE	ENABLE	IN	NON INVERT OUTPUT	INVERT OUTPUT
O	I	X	HiZ	HiZ
I	X	O	O	I
X	O	O	O	I
I	X	I	I	O
X	O	I	I	O

X = Don't Care

Harris Semiconductor

CAUTION: These devices are sensitive to electrostatic discharge. Proper I.C. handling procedures should be followed.
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File Number **2929**

When contacting suppliers, say you saw it in IC MASTER

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HYUNDAI SEMICONDUCTOR

HYUNDAI PRODUCT AVAILABILITY

PRODUCT	DESCRIPTION	PART #	PACKAGE OPTIONS	ACCESS TIME (NS)	OPERATING CURRENT	STANDBY CURRENT		PRODUCTION
					Icc (Max, mA)	Isb (MAX, mA)		
						STD	LOW	
SRAM	2K×8	HY6116A	DIP	85/100/120/150	60	0.05	0.002	NOW
		HY6116C	DIP	70/100/120/150	50	0.05	0.005	NOW
	8K×8	HY6264A	DIP, SOP	70/85/100/120/150	50	3	0.1	NOW
	32K×8	HY62256A	DIP, SOP	70/85/100/120	70	1	0.1	NOW
DRAM	256K×1, FAST PAGE	HY53C256	DIP, PLCC	70/80/100	70/60/50	3	2	NOW
	64K×4, FAST PAGE	HY53C464	DIP, PLCC	70/80/100	70/60/50	3	2	NOW
	1M×1, FAST PAGE	HY531000	DIP, SOJ	60/70/80/100	85/75/65/55	2		NOW
	256K×4, FAST PAGE	HY534256	DIP, SOJ	60/70/80/100	90/80/70/60	2		NOW
	4M×1, FAST PAGE	HY514100	SOJ, TSOP	70/80	90/80	2		NOW
	1M×4, FAST PAGE	HY514400	SOJ, TSOP	70/80	95/85	2		NOW
	512K×8	HY524800	SOJ	70/80	105	2		NOW
EEPROM	1K SERIAL (64×16)	HY93C46	DIP, SOP	250KHz	3	1		NOW

PRODUCT	DESCRIPTION	PART #	COMPLEXITY (GATE)	USABLE (GATE)	GATE SPEED TYPE (NS)	I/O PADS MAX	PACKAGE OPTION	PRODUCTION
ASIC	CHANNELED GATE ARRAY	HGA7000 SERIES	880-10013	UP TO 7,000	1.4	216	DIP/PLCC/ LCC/QFP/PGA	NOW
	SEA OF GATE ARRAY	HSG 1K/10K SERIES	1386-215364	UP TO 85,000	0.5	348		NOW

HYUNDAI ELECTRONICS AMERICA
166 Baypointe Parkway • San Jose, CA 95134 • (408) 473-9200,
Dallas (214) 770-1930, Chicago (708) 860-6406, New Jersey (201) 261- 4446

ISI IDEAL SEMICONDUCTOR, INC.
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ADVANCED HIGH-SPEED CMOS LOGIC PRODUCTS

THE 54/74 AHCT Family is a direct plug-in replacement for 54/74ALS.

Part Number	Description	Indicative Max. Speed (ns) Mil.	Com'l.	Max. ICC (μA) Mil.	Com'l.
54/74AHCT00	Quad 2-Input NAND Gates	12	10	40	20
54/74AHCT01	Quad 2-Input NAND Gates with Open-Drain Outputs	37	31	40	20
54/74AHCT02	Quad 2-Input NOR Gates	13	11	40	20
54/74AHCT03	Quad 2-Input NAND Gates with Open-Drain Outputs	37	31	40	20
54/74AHCT04	Hex Inverters	12	10	40	20
54/74AHCT05	Hex Inverters with Open-Drain Outputs	37	31	40	20
54/74AHCT08	Quad 2-Input AND Gates	14	12	40	20
54/74AHCT09	Quad 2-Input AND Gates with Open-Drain Outputs	37	31	40	20
54/74AHCT10	Triple 3-Input NAND Gates	18	15	40	20
54/74AHCT11	Triple 3-Input AND Gates	18	15	40	20
54/74AHCT12	Triple 3-Input NAND Gates with Open Drain Outputs	37	31	40	20
54/74AHCT14	Hex Schmitt-Trigger Inverters	17	14	40	20
54/74AHCT32	Quad 2-Input OR Gates	16	13	40	20
54/74AHCT51	Dual AND-OR-Invert Gates	18	15	40	20
54/74AHCT58	Dual AND-OR Gates	18	15	40	20
54/74AHCT73	Dual J-K Negative-Edge-Triggered Flip-Flops with Clear	20	17	80	40
54/74AHCT74	Dual D-Type Positive-Edge-Triggered Flip-Flops with Preset and Clear	20	17	80	40
54/74AHCT86	Quad 2-Input Exclusive-or Gates	13	11	40	20
54/74AHCT107	Dual J-K Negative-Edge-Triggered Flip-Flops with Clear	20	17	80	40
54/74AHCT109	Dual J-K Positive-Edge-Triggered Flip-Flops with Preset and Clear	20	17	80	40
54/74AHCT112	Dual J-K Negative-Edge-Triggered Flip-Flops with Preset and Clear	20	17	80	40
54/74AHCT121	Monostable Multivibrators with Schmitt-Trigger Inputs				
54/74AHCT123	Dual Retriggerable Monostable Multivibrators				
54/74AHCT138	3-Line to 8-Line Decoders/	24	20	160	80
54/74AHCT139	Dual 1-of-4 Decoders/Multiplexers	20	17	160	80
54/74AHCT148	8-Line 3-Line Priority Encoders	20	17	160	80
54/74AHCT155	Dual 2-4 Line Decoders/Multiplexers	22	18	160	80
54/74AHCT157	Quad 2-Line to 1-Line Data Selectors/Multiplexers	14	11	160	80
54/74AHCT158	Quad 2-Line to 1-Line Data Selectors/Multiplexers	14	11	160	80
54/74AHCT161	Synchronous 4-Bit Binary Counters	19	16	160	80
54/74AHCT163	Synchronous 4-Bit Binary Counters	20	16	160	80
54/74AHCT164	8-Bit Serial-In/Parallel-Out Shift Registers	24	20	160	80
54/74AHCT165	8-Bit Parallel-In/Serial-Out Registers	30	25	160	80
54/74AHCT166	8-Bit Parallel-In/Serial-Out Shift Registers with Clear	20	17	160	80
54/74AHCT173	4-Bit D-Type Registers with 3-State Outputs	25	21	160	80
54/74AHCT174	Hex D-Type Flip-Flops with Clear	19	16	160	80
54/74AHCT175	Quad D-Type Flip-Flops with Clear	19	16	160	80
54/74AHCT191	Synchronous 4-Bit Up/Down Binary Counters	30	25	160	80
54/74AHCT193	Synchronous 4-Bit Up/Down Binary Counters with Dual Clock	23	19	160	80
54/74AHCT240	Octal Buffers and Line Drivers with 3-State Outputs	12	10	160	80
54/74AHCT241	Octal Buffers and Line Drivers with 3-State Outputs	12	10	160	80
54/74AHCT244	Octal Buffers and Line Drivers with 3-State Outputs	12	10	160	80
54/74AHCT245	Octal Bus Transceivers with 3-State Outputs	14	10	160	80
54/74AHCT257	Quad 2-Line to 1-Line Data Selectors/Multiplexers with 3-State Outputs	12	10	160	80
54/74AHCT258	Quad 2-Line to-Line Data Selectors/Multiplexers with 3-State Outputs	12	10	160	80
54/74AHCT259	8-Bit Addressable Latches	24	20	160	80
54/74AHCT266	Quad Exclusive -NOR Gates with Open-Drain Outputs	37	31	40	20
54/74AHCT273	Octal D-Type Flip-Flops with Clear	17	14	160	80
54/74AHCT299	8-Bit Universal Shift/Storage Registers with 3-State Outputs	20	17	160	80
54/74AHCT365	Hex Bus-Drivers with 3-State Outputs	14	12	160	80
54/74AHCT366	Hex Bus-Drivers with 3-State Outputs	12	10	160	80
54/74AHCT367	Hex Bus-Drivers with 3-State Outputs	14	12	160	80
54/74AHCT368	Hex Bus-Drivers with 3-State Outputs	12	10	160	80

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ADVANCED HIGH-SPEED CMOS LOGIC PRODUCTS

Part Number	Description	Indicative Max. Speed (ns) Mil.	Com'l.	Max. ICC (µA) Mil.	Com'l.
54/74AHCT373	Octal D-Type Transparent Latches with 3-State Outputs	17	14	160	80
54/74AHCT374	Octal D-Type Flip-Flops with 3-State Outputs	17	14	160	80
54/74AHCT393	Dual 4-Bit Binary Counters	16	13	160	80
54/74AHCT399	Quad 2-Port Registers	23	19	160	80
54/74AHCT423	Dual Retriggerable Monostable Multivibrators				
54/74AHCT533	Octal D-Type Transparent Latches with 3-State Outputs	19	16	160	80
54/74AHCT534	Octal D-Type Transparent Flip-Flops with 3-State Outputs	17	14	160	80
54/74AHCT540	Octal Buffers and Line Drivers with 3-State Outputs	12	10	160	80
54/74AHCT541	Octal Buffers and Line Drivers with 3-State Outputs	12	10	160	80
54/74AHCT563	Octal D-TypeTransparent Latches with 3-State Outputs	17	14	160	80
54/74AHCT564	Octal D-Type Flip-Flops with 3-State Outputs	17	14	160	80
54/74AHCT573	Octal D-Type Transparent Latches with 3-State Outputs	17	14	160	80
54/74AHCT574	Octal D-Type Flip-Flops with 3-State Outputs	17	14	160	80
54/74AHCT590	8-Bit Binary Counters with 3-State Output Register				
54/74AHCT592	8-Bit Binary Counters with Input Register				
54/74AHCT593	8-Bit Binary Counters with Bidirectional Input Register/Counter Output				
54/74AHCT640	Octal Bus Transceivers	14	11	160	80
54/74AHCT643	Octal Bus Transceivers	14	11	160	80
54/74AHCT646	Octal 3-State Bus Transceivers with Registers	18	11	160	80
54/74AHCT648	Octal 3-State Bus Transceivers with Registers	18	11	160	80

HIGH-SPEED CMOS LOGIC PRODUCTS

The 54/74HCTLS Family is a direct plug-in replacement for industry standard 54/74LS and 54/764HCT.

Part Number	Description	Indicative Max. Speed (ns) Mil.	Com'l.	Max. ICC (µA) Mil.	Com'l.
54/74HCTLS00	Quad 2-Input NAND Gates	22	18	40	20
54/74HCTLS01	Quad 2-Input NAND Gates with Open-Drain Outputs	37	31	40	20
54/74HCTLS02	Quad 2-Input NOR Gates	22	18	40	20
54/74HCTLS03	Quad 2-Input NAND Gates with Open Drain Outputs	37	31	40	20
54/74HCTLS04	Hex Inverters	22	18	40	20
54/74HCTLS05	Hex Inverters with Open-Drain Outputs	37	31	40	20
54/74HCTLS08	Quad 2-Input AND Gates	30	25	40	20
54/74HCTLS09	Quad 2-Input AND Gates with Open-Drain Outputs	37	31	40	20
54/74HCTLS10	Triple 3-Input NAND Gates	22	18	40	20
54/74HCTLS11	Triple 3-Input AND Gates	30	25	40	20
54/74HCTLS12	Triple 3-Input NAND Gates with Open-Drain Outputs	37	31	40	20
54/74HCTLS14	Hex Schmitt-Trigger Inverters	33	28	40	20
54/74HCTLS32	Quad 2-Input OR Gates	26	22	40	20
54/74HCTLS51	Dual AND-OR-Invert Gates	30	25	40	20
54/74HCTLS58	Dual AND-OR Gates	30	25	40	20
54/74HCTLS73A	Dual J-K Negative-Edge-Triggered Flip-Flops with Clear	30	25	80	40
54/74HCTLS74A	Dual D-Type Positive-Edge-Triggered Flip-Flops with Preset and Clear	37	31	80	40
54/74HCTLS76A	Dual J-K Flip-Flops with Preset and Clear	30	25	80	40
54/74HCTLS78A	Dual J-K Flip-Flops with Preset and Common Clear and Clock	30	25	80	40
54/74HCTLS86	Quad 2-Input Exclusive-OR Gates	30	25	40	20
54/74HCTLS107A	Dual J-K Negative-Edge-Triggered Flip-Flops with Clear	30	25	80	40
54/74HCTLS109	Dual J-K Positive-Edge-Triggered Flip-Flops with Preset and Clear	37	31	80	80

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HIGH-SPEED CMOS LOGIC PRODUCTS

Part Number	Description	Indicative Max. Speed (ns) Mil.	Indicative Max. Speed (ns) Com'l.	Max. ICC (µA) Mil.	Max. ICC (µA) Com'l.
54/74HCTLS112A	Dual J-K Triggered Flip-Flops with Preset and Clear	30	25	80	40
54/74HCTLS121	Monostable with Schmitt-Trigger Inputs				
54/74HCTLS123	Dual Retriggerable Monostable Multivibrators				
54/74HCTLS138	3-Line to 8-Line Decoders/Multiplexers	45	37	160	80
54/74HCTLS139	Dual 1-to-4 Line Decoders/Multiplexers	45	37	160	80
54/74HCTLS148	8-Line to 3-Line Priority Encoders	41	34	160	80
54/74HCTLS155	Dual 2-to-4 Line Decoders/Multiplexers	35	29	160	80
54/74HCTLS157	Quad 2-Line to 1-Line Data Selectors/Multiplexers	21	18	160	80
54/74HCTLS158	Quad 2-Line to 1-Line Data Selectors/Multiplexers	21	18	160	80
54/74HCTLS161A	Synchronous 4-Bit Binary Counters	53	44	160	80
54/74HCTLS163A	Synchronous 4-Bit Binary Counters	53	44	160	80
54/74HCTLS164	8-Bit Serial-In/Parallel-Out Shift Registers	54	45	160	80
54/74HCTLS165	8-Bit Serial-In/Parallel-Out Shift Registers	53	44	160	80
54/74HCTLS166	8-Bit Serial-In/Parallel-Out Shift Registers with Clear	45	37	160	80
54/74HCTLS173	4-Bit D-Type Registers with 3-State Outputs	41	34	160	80
54/74HCTLS174	Hex D-Type Flip-Flops with Clear	45	37	160	80
54/74HCTLS175	Quad D-Type Flip-Flops with Clear	37	31	160	80
54/74HCTLS191	Synchronous 4-Bit Up/Down Binary Counters	60	50	160	80
54/74HCTLS193	Synchronous 4-Bit Up/Down Binary Counters with Dual Clock	37	31	160	80
54/74HCTLS240	Octal Buffers and Line Drivers with 3-State Outputs	27	22	160	80
54/74HCTLS241	Octal Buffers and Line Drivers with 3-State Outputs	27	22	160	80
54/74HCTLS244	Octal Buffers and Line Drivers with 3-State Outputs	27	22	160	80
54/74HCTLS245	Octal Bus Transceivers with 3-State Outputs	18	15	160	80
54/74HCTLS257	Quad 2-Line to 1-Line Data Selectors/Multiplexers with 3-State Outputs	27	23	160	80
54/74HCTLS258	Quad 2-Line to 1-Line Data Selectors/Multiplexers with 3-State Outputs	27	23	160	80
54/74HCTLS259	8-Bit Addressable Latches	45	37	160	80
54/74HCTLS266	Quad Exclusive-NOR Gates with Open-Drain Outputs	37	31	40	20
54/74HCTLS273	Octal D-Type Flip-Flops with Clear	40	33	160	80
54/74HCTLS299	8-Bit Universal Shift/Storage Registers with 3-State Outputs	53	44	160	80
54/74HCTLS365A	Hex Bus-Drivers with 3-Bit Outputs	28	24	160	80
54/74HCTLS366A	Hex Bus-Drivers with 3-Bit Outputs	25	21	160	80
54/74HCTLS367A	Hex Bus-Drivers with 3-Bit Outputs	28	24	160	80
54/74HCTLS368A	Hex Bus-Drivers with 3-Bit Outputs	25	21	160	80
54/74HCTLS373	Octal D-Type Transparent Latches with 3-State Outputs	27	23	160	80
54/74HCTLS374	Octal D-Type Flip-Flops with 3-State Outputs	42	35	160	80
54/74HCTLS393	Dual 4-Bit Binary Counters	30	25	160	80
54/74HCTLS399	Quad 2-Part Registers	45	37	160	80
54/74HCTLS533	Octal D-Type Transparent Latches with 3-State Outputs	27	23	160	80
54/74HCTLS534	Octal D-Type Flip-Flops with 3-State Outputs	42	35	160	80
54/74HCTLS540	Octal Buffers and Line Drivers with 3-State Outputs	23	19	160	80
54/74HCTLS541	Octal Buffers and Line Drivers with 3-State Outputs	23	19	160	80
54/74HCTLS563	Octal D-Type Transparent Latches with 3-State Outputs	27	23	160	80
54/74HCTLS564	Octal D-Type Flip-Flops with 3-State Outputs	42	35	160	80
54/74HCTLS573	Octal D-Type transparent Latches with 3-State Outputs	27	23	160	80
54/74HCTLS574	Octal D-Type Flip-Flops with 3-State Outputs	42	35	160	80
54/74HCTLS590	8-Bit Binary Counters with 3-State Output Register				
54/74HCTLS592	8-Bit Binary Counters with Input Register				
54/74HCTLS593	8-Bit Binary Counters with Bidirectional Input Register/Counter Output				
54/74HCTLS640	Octal Bus Transceivers	18	15	160	80
54/74HCTLS643	Octal Bus Transceivers	18	15	160	80
54/74HCTLS646	Octal 3-State Bus Transceivers with Registers	29	24	160	80
54/74HCTLS648	Octal 3-State Bus Transceivers with Registers	29	24	160	80

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HIGH-SPEED CMOS LOGIC PRODUCTS

Part Number	Description
25C02	8 Bit TTL Successive Approximation Register (Direct Plug In Replacements for the AM2502 and DM2502, TTL Successive Approximation Registers)
25C03	8 Bit TTL Successive Approximation Register (Direct Plug In Replacement for the AM2503 and DM2503, TTL Successive Approximation Registers)
25C04	12 Bit TTL Successive Approximation Register (Direct Plug In Replacement for the AM2504 and DM2504, TTL Successive Approximation Registers)
29C01	4 Bit CMOS Microprocessor Slice (Pin for Pin Replacement for the Bipolar 2901)
29C09 A/B	CMOS Microprogram Sequencer (Pin for Pin Replacement for the Bipolar 2909, A Version meets Bipolar 2909 A speeds, B version improves speed 20%)
29C10	CMOS Microprogram Controller (Pin for Pin Replacement for the Bipolar 2910)
29C11 A/B	CMOS Microprogram Sequencer (Pin for Pin Replacement for the Bipolar 2911, A Version meets Bipolar 2911 A speeds, B version improves speed 20%)

Military Packaging and Screening

The Ideal Semiconductor high reliability program offers any Jedec hermetically sealed package, processed to the criteria of Mil-Std-883, class B or Class S or to the requirements of customer source control drawings. Product screened to these high reliability standards is offered on every part type available from Ideal Semiconductor and is available now.

Radiation Hardened Product

A key feature of the process used by Ideal Semiconductor is that Ideal offers extremely high levels of radiation resistance. Several radiation tests were performed by Major Military Aerospace companies on the AHCT and HCTLS product lines. These product lines typically exhibited total dose resistance of 500k rads to 1 megaRAD and higher.
Additional process enhancements in development are designed to increase the radiation resistance two to three times greater than current levels.

About the Company

Ideal Semiconductor is a Woman Owned Small Business which began operations in 1987. By continuing to build with the Original Manufacturers Tooling and Wafers, Ideal "Bridges the Gap" created when the major semiconductor manufactures obsolete or discontinue their product lines. The special package and test requirements of Specification Control Drawings which are no longer procurable from the original semiconductor manufacturer, can also be supported by Ideal Semiconductor.

Additional Product Lines are Regularly acquired from the Original Semiconductor Manufacturers. If your programs require obsolete microcircuits, semiconductors or Hybrids, call Ideal Semiconductor before you redesign. We will manufacture new product to your specifications using the same exact circuitry.

Our radiation hardness testing provides total dose or non-destructive latch up/dose rate measurements of individual devices on wafers or packaged devices.

Our manufacturing processes are in accordance with Mil-Std-883, Class B and Class S, Mil-M-38510/19500 and Mil-Std-750/202. Our quality assurance program is in accordance with Mil-I-45208A. Our calibration procedures are in accordance with Mil-I-45662A.

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PRELIMINARY

iMC002FLKA
2-MBYTE FLASH MEMORY CARD

- **Inherent Nonvolatility (Zero Retention Power)**
  - **No Batteries Required for Back-up**
- **Over 1,000,000 Hours MTBF**
  - **More Reliable than Disk**
- **High-Performance Read**
  - **200 ns Maximum Access Time**
- **CMOS Low Power Consumption**
  - **25 mA Typical Active Current (X8)**
  - **400 μA Typical Standby Current**
- **Flash Electrical Zone-Erase**
  - **2 Seconds Typical per 256 kByte Zone**
  - **Multiple Zone-Erase**
- **Random Writes to Erased Zones**
  - **10 μs Typical Byte Write**
- **Write Protect Switch to Prevent Accidental Data Loss**
- **Command Register Architecture for Microprocesssor/Microcontroller Compatible Write Interface**
- **ETOX™ II Flash Memory Technology**
  - **5V Read, 12V Erase/Write**
  - **High-Volume Manufacturing Experience**
- **PCMCIA/JEIDA 68-Pin Standard**
  - **Byte- or Word-wide Selectable**
- **Independent Software & Hardware Vendor Support**
  - **Integrated System Solution Using Flash Filing Systems**
- **ExCA™ Compatible**

Intel's Flash Memory Card is the integrated memory solution for portable PCs. The iMC002FLKA enables OEM system manufacturers to design portable PCs that no longer require rotating electro-mechanical media to store application code and data files. This allows the design and manufacture of PCs that are higher performance, more rugged, consume less battery power, and weigh much less than traditional disk-based portable PCs. The flash memory card supports the emerging "Mobile Office" by allowing the user to transport both application code and data files between desktop PCs and portables.

Intel

The iMC002FLKA conforms to the PCMCIA/JEIDA international standard, providing standardization at the hardware and data interchange level. OEMs may opt to write the Card Information Structure (CIS) at the memory card's address 00000H with a format utility. This information provides data interchange functional capability. The 200 ns access time allows for "execute-in-place" capability, for popular low-power microprocessors. Intel's 2-MByte Flash Memory Card operates in a byte-wide and word-wide configuration providing performance/power options for different systems.

The iMC002FLKA Flash Memory card is compatible with the Intel Exchangeable Card Architecture (ExCA™) as are all members of the Flash Memory Card Family. ExCA is an open system implementation of PCMCIA Rel 2.0, standardizing on the 68 pin connector for both memory and I/O, thus ensuring inter-operability and exchangeability from system to system, independent of manufacturer.

Intel's Flash Memory card employs Intel's ETOX™ II Flash Memories. Filing systems, such as Microsoft's* Flash File System (FFS), facilitate sequential data file storage and card erasure using a purely nonvolatile medium. Flash filing systems, coupled with the Intel Flash Memory Card, effectively create an all-silicon nonvolatile read/write random access memory system that is more reliable and higher performance than disk-based memory systems.

*Microsoft is a trademark of Microsoft Corp.
ExCA™ is a trademark of Intel Corporation.

Intel Corporation assumes no responsibility for the use of any circuitry other than circuitry embodied in an Intel product. No other circuit patent licenses are implied. Information contained herein supersedes previously published specifications on these devices from Intel.
October 1991
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Order Number: 290412-001

PRELIMINARY

iMC001FLKA
1-MBYTE FLASH MEMORY CARD

- **Inherent Nonvolatility (Zero Retention Power)**
  - **No Batteries Required for Back-Up**
- **Over 1,000,000 Hours MTBF**
  - **More Reliable than Disk**
- **High-Performance Read**
  - **200 ns Maximum Access Time**
- **CMOS Low Power Consumption**
  - **25 mA Typical Active Current (X8)**
  - **400 μA Typical Standby Current**
- **Flash Electrical Zone-Erase**
  - **1 Second Typical per 128 kByte Zone**
  - **Multiple Zone Erase > 128 kB/s**
- **Random Writes to Erased Zones**
  - **10 μs Typical Byte Write**
- **Write Protect Switch to Prevent Accidental Data Loss**
- **Command Register Architecture for Microprocessor/Microcontroller Compatible Write Interface**
- **ETOX™ II Flash Memory Technology**
  - **5V Read, 12V Erase/Write**
  - **High-Volume Manufacturing Experience**
- **PCMCIA/JEIDA 68-Pin Standard**
  - **Byte- or Word-Wide Selectable**
- **Independent Software & Hardware Vendor Support**
  - **Integrated System Solution Using Flash Filing Systems**
- **ExCA™ Compatible**

Intel's Flash Memory Card is the integrated memory soiution for portable PCs. The iMC001FLKA enables OEM system manufacturers to design portable PCs that no longer require rotating electro-mechanical media to store application code and data files. This allows the design and manufacture of PCs that are higher performance, more rugged, consume less battery power, and weigh much less than traditional disk-based portable PCs. The flash memory card supports the emerging "Mobile Office" by allowing the user to transport both application code and data files between desktop PCs and portables.

The iMC001FLKA conforms to the PCMCIA/JEIDA international standard, providing compatibility at the hardware and data interchange level. OEMs may opt to write the Card Information Structure (CIS) at the memory card's address 00000H with a format utility. This information provides data interchange functional compatibility. The 200 ns access time allows for "execute-in-place" capability, for popular low-power microprocessors. Intel's 1-MByte Flash Memory Card operates in a byte-wide and word-wide configuration providing performance/power options for different systems.

The iMC001FLKA Flash Memory card is compatible with the Intel Exchangeable Card Architecture (ExCA™) as are all members of the Flash Memory Card Family. ExCA is an open system implementation of PCMCIA Rel. 2.0, standardizing on the 68-pin connector for both memory and I/O, thus ensuring inter-operability and exchangeability from system to system, independent of manufacturer.

Intel's Flash Memory card employs Intel's ETOX™ II Flash Memories. Filing systems, such as Microsoft's* Flash File System (FFS), facilitate sequential data file storage and card erasure using a purely nonvolatile medium. Flash filing systems, coupled with the Intel Flash Memory Card, effectively create an all-silicon nonvolatile read/write random access memory system that is more reliable and higher performance than disk-based memory systems.

*Microsoft is a trademark of Microsoft Corp.
ExCA is a trademark of Intel Corporation.

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Order Number: 290399-002

iMC004FLKA
4-MBYTE FLASH MEMORY CARD

- **Inherent Nonvolatility (Zero Retention Power)**
  - **No Batteries Required for Back-up**
- **Over 1,000,000 Hours MTBF**
  - **More Reliable than Disk**
- **High-Performance Read**
  - **200 ns Maximum Access Time**
- **CMOS Low Power Consumption**
  - **40 mA Typical Active Current (X8)**
  - **800 μA Typical Standby Current**
- **Flash Electrical Zone-Erase**
  - **2 Seconds Typical per 256 kByte Zone**
  - **Multiple Zone-Erase**
- **Random Writes to Erased Zones**
  - **10 μs Typical Byte Write**
- **Write Protect Switch to Prevent Accidental Data Loss**
- **Command Register Architecture for Microprocesssor/Microcontroller Compatible Write Interface**
- **ETOX™ II Flash Memory Technology**
  - **5V Read, 12V Erase/Write**
  - **High-Volume Manufacturing Experience**
- **PCMCIA/JEIDA 68-Pin Standard**
  - **Byte- or Word-wide Selectable**
- **Independent Software & Hardware Vendor Support**
  - **Integrated System Solution Using Flash Filing Systems**
- **ExCA™ Compatible**

Intel's Flash Memory Card is the integrated memory solution for portable PCs. The iMC004FLKA enables OEM system manufacturers to design portable PCs that no longer require rotating electro-mechanical media to store application code and data files. This allows the design and manufacture of PCs that are higher performance, more rugged, consume less battery power, and weigh much less than traditional disk-based portable PCs. The flash memory card supports the emerging "Mobile Office" by allowing the user to transport both application code and data files between desktop PCs and portables.

Intel

The iMC004FLKA conforms to the PCMCIA/JEIDA international standard, providing standardization at the hardware and data interchange level. OEMs may opt to write the Card Information Structure (CIS) at the memory card's address 00000H with a format utility. This information provides data interchange functional capability. The 200 ns access time allows for "execute-in-place" capability, for popular low-power microprocessors. Intel's 4-MByte Flash Memory Card operates in a byte-wide and word-wide configuration providing performance/power options for different systems.

The iMC004FLKA Flash Memory card is compatible with the Intel Exchangeable Card Architecture (ExCA™) as are all members of the Flash Memory Card Family. ExCA is an open system implementation of PCMCIA Rel 2.0, standardizing on the 68-pin connector for both memory and I/O, thus ensuring inter-operability and exchangeability from system to system, independent of manufacturer.

Intel's Flash Memory card employs Intel's ETOX II Flash Memories. Filing systems, such as Microsoft's* Flash File System (FFS), facilitate sequential data file storage and card erasure using a purely nonvolatile medium. Flash filing systems, coupled with the Intel Flash Memory Card, effectively create an all-silicon nonvolatile read/write random access memory system that is more reliable and higher performance than disk-based memory systems.

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28F256A
256K (32K x 8) CMOS FLASH MEMORY

- **Flash Electrical Chip-Erase**
  - **1 Second Typical Chip-Erase**
- **Quick-Pulse Programming Algorithm**
  - **10 μs Typical Byte-Program**
  - **0.5 Second Chip-Program**
- **10,000 Erase/Program Cycles Minimum**
- **12.0V ±5% V_{PP}**
- **High-Performance Read**
  - **120 ns Maximum Access Time**
- **CMOS Low Power Consumption**
  - **10 mA Typical Active Current**
  - **50 μA Typical Standby Current**
  - **0 Watts Data Retention Power**
- **Integrated Program/Erase Stop Timer**
- **Command Register Architecture for Microprocessor/Microcontroller Compatible Write Interface**
- **Noise Immunity Features**
  - **± 10% V_{CC} Tolerance**
  - **Maximum Latch-Up Immunity through EPI Processing**
- **ETOX™ II Flash Nonvolatile Technology**
  - **EPROM-Compatible Process Base**
  - **High-Volume Manufacturing Experience**
- **JEDEC-Standard Pinouts**
  - **32-Pin Cerdip**
  - **32-Lead PLCC**

  (See Packaging Spec., Order #231369)

Intel's 28F256A CMOS flash memory offers the most cost-effective and reliable alternative for read/write random access nonvolatile memory. The 28F256A adds electrical chip-erasure and reprogramming to familiar EPROM technology. Memory contents can be rewritten: in a test socket; in a PROM-programmer socket; on-board during subassembly test; in-system during final test; and in-system after-sale. The 28F256A increases memory flexibility, while contributing to time and cost savings.

The 28F256A is a 256-kilobit nonvolatile memory organized as 32,768 bytes of 8 bits. Intel's 28F256A is offered in 32-pin plastic dip and 32-lead PLCC. Pin assignments conform to JEDEC standards.

Extended erase and program cycling capability is designed into Intel's ETOX™ II (EPROM Tunnel Oxide) process technology. Advanced oxide processing, an optimized tunneling structure, and lower electric field combine to extend reliable cycling beyond that of traditional EEPROMs. With the 12.0V V_{PP} supply, the 28F256A performs a minimum of 10,000 erase and program cycles well within the time limits of the Quick-Pulse Programming and Quick-Erase algorithms.

Intel's 28F256A employs advanced CMOS circuitry for systems requiring high-performance access speeds, low power consumption, and immunity to noise. Its 120 ns access time provides no-WAIT-state performance for a wide range of microprocessors and microcontrollers. Typical standby current of 50 μA translates into power savings when the device is deselected. Finally, the highest degree of latch-up protection is achieved through Intel's unique EPI processing. Prevention of latch-up is provided for stresses up to 100 mA on address and data pins, from $-1V$ to $V_{CC} + 1V$.

With Intel's ETOX II process base, the 28F256A levers years of EPROM experience to yield the highest levels of quality, reliability, and cost-effectiveness.

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28F512
512K (64K x 8) CMOS FLASH MEMORY

- **Flash Electrical Chip-Erase**
  - **1 Second Typical Chip-Erase**
- **Quick-Pulse Programming Algorithm**
  - **10 μs Typical Byte-Program**
  - **1 Second Chip-Program**
- **10,000 Erase/Program Cycle Minimum**
- **12.0V ±5% V_{PP}**
- **High-Performance Read**
  - **120 ns Maximum Access Time**
- **CMOS Low Power Consumption**
  - **10 mA Typical Active Current**
  - **50 μA Typical Standby Current**
  - **0W Data Retention Power**
- **Integrated Program/Erase Stop Timers**
- **Command Register Architecture for Microprocessor/Microcontroller Compatible Write Interface**
- **Noise Immunity Features**
  - **± 10% V_{CC} Tolerance**
  - **Maximum Latch-Up Immunity through EPI Processing**
- **ETOX™ II Nonvolatile Flash Technology**
  - **EPROM-Compatible Process Base**
  - **High-Volume Manufacturing Experience**
- **JEDEC-Standard Pinouts**
  - **32-Pin Plastic Dip**
  - **32-Lead PLCC**

  (See Packaging Spec., Order #231369)

Intel's 28F512 CMOS flash memory offers the most cost-effective and reliable alternative for read/write random access nonvolatile memory. The 28F512 adds electrical chip-erasure and reprogramming to familiar EPROM technology. Memory contents can be rewritten: in a test socket; in a PROM-programmer socket; on-board during subassembly test; in-system during final test; and in-system after-sale. The 28F512 increases memory flexibility, while contributing to time- and cost-savings.

The 28F512 is a 512-kilobit nonvolatile memory organized as 65,536 bytes of 8 bits. Intel's 28F512 is offered in 32-pin plastic dip or 32-lead PLCC packages. Pin assignments conform to JEDEC standards for byte-wide EPROMs.

Extended erase and program cycling capability is designed into Intel's ETOX II (EPROM Tunnel Oxide) process technology. Advanced oxide processing, an optimized tunneling structure, and lower electric field combine to extend reliable cycling beyond that of traditional EEPROMs. With the 12.0V V_{PP} supply, the 28F512 performs a minimum of 10,000 erase and program cycles well within the time limits of the Quick-Pulse Programming™ and Quick-Erase™ algorithms.

Intel's 28F512 employs advanced CMOS circuitry for systems requiring high-performance access speeds, low power consumption, and immunity to noise. Its 120 nanosecond access time provides no-WAIT-state performance for a wide range of microprocessors and microcontrollers. Maximum standby current of 100 μA translates into power savings when the device is deselected. Finally, the highest degree of latch-up protection is achieved through Intel's unique EPI processing. Prevention of latch-up is provided for stresses up to 100 mA on address and data pins, from $-1V$ to $V_{CC} + 1V$.

With Intel's ETOX II process base, the 28F512 levers years of EPROM experience to yield the highest levels of quality, reliability, and cost-effectiveness.

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28F010
1024K (128K x 8) CMOS FLASH MEMORY

- **Flash Electrical Chip-Erase**
  - **1 Second Typical Chip-Erase**
- **Quick-Pulse Programming Algorithm**
  - **10 μs Typical Byte-Program**
  - **2 Second Chip-Program**
- **10,000 Erase/Program Cycles Minimum**
- **12.0V ±5% V_{PP}**
- **High-Performance Read**
  - **120 ns Maximum Access Time**
- **CMOS Low Power Consumption**
  - **10 mA Typical Active Current**
  - **50 μA Typical Standby Current**
  - **0 Watts Data Retention Power**
- **Integrated Program/Erase Stop Timer**
- **Command Register Architecture for Microprocessor/Microcontroller Compatible Write Interface**
- **Noise Immunity Features**
  - **± 10% V_{CC} Tolerance**
  - **Maximum Latch-Up Immunity through EPI Processing**
- **ETOX™ II Nonvolatile Flash Technology**
  - **EPROM-Compatible Process Base**
  - **High-Volume Manufacturing Experience**
- **JEDEC-Standard Pinouts**
  - **32-Pin Plastic Dip**
  - **32-Lead PLCC**
  - **32-Lead TSOP**

(See Packaging Spec., Order #231369)

Intel's 28F010 CMOS flash memory offers the most cost-effective and reliable alternative for read/write random access nonvolatile memory. The 28F010 adds electrical chip-erasure and reprogramming to familiar EPROM technology. Memory contents can be rewritten: in a test socket; in a PROM-programmer socket; on-board during subassembly test; in-system during final test; and in-system after-sale. The 28F010 increases memory flexibility, while contributing to time- and cost-savings.

The 28F010 is a 1024-kilobit nonvolatile memory organized as 131,072 bytes of 8 bits. Intel's 28F010 is offered in 32-pin plastic dip or 32-lead PLCC and TSOP packages. Pin assignments conform to JEDEC standards for byte-wide EPROMs.

Extended erase and program cycling capability is designed into Intel's ETOX II (EPROM Tunnel Oxide) process technology. Advanced oxide processing, an optimized tunneling structure, and lower electric field combine to extend reliable cycling beyond that of traditional EEPROMs. With the 12.0V V_{PP} supply, the 28F010 performs a minimum of 10,000 erase and program cycles well within the time limits of the Quick-Pulse Programming and Quick-Erase algorithms.

Intel's 28F010 employs advanced CMOS circuitry for systems requiring high-performance access speeds, low power consumption, and immunity to noise. Its 120 nanosecond access time provides no-WAIT-state performance for a wide range of microprocessors and microcontrollers. Maximum standby current of 100 μA translates into power savings when the device is deselected. Finally, the highest degree of latch-up protection is achieved through Intel's unique EPI processing. Prevention of latch-up is provided for stresses up to 100 mA on address and data pins, from $-1V$ to $V_{CC} + 1V$.

With Intel's ETOX II process base, the 28F010 levers years of EPROM experience to yield the highest levels of quality, reliability, and cost-effectiveness.

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28F020
2048K (256K x 8) CMOS FLASH MEMORY

- **Flash Electrical Chip-Erase**
  - **2 Second Typical Chip-Erase**
- **Quick-Pulse Programming™ Algorithm**
  - **10 μs Typical Byte-Program**
  - **4 Second Chip-Program**
- **10,000 Erase/Program Cycles Minimum**
- **12.0V ±5% V_{PP}**
- **High-Performance Read**
  - **150 ns Maximum Access Time**
- **CMOS Low Power Consumption**
  - **10 mA Typical Active Current**
  - **50 μA Typical Standby Current**
  - **0 Watts Data Retention Power**
- **Integrated Program/Erase Stop Timer**
- **Command Register Architecture for Microprocessor/Microcontroller Compatible Write Interface**
- **Noise Immunity Features**
  - **± 10% V_{CC} Tolerance**
  - **Maximum Latch-Up Immunity through EPI Processing**
- **ETOX™ II Nonvolatile Flash Technology**
  - **EPROM-Compatible Process Base**
  - **High-Volume Manufacturing Experience**
- **JEDEC-Standard Pinouts**
  - **32-Pin Plastic Dip**
  - **32-Lead PLCC**
  - **32-Lead TSOP**

(See Packaging Spec., Order #231369)

Intel's 28F020 CMOS flash memory offers the most cost-effective and reliable alternative for read/write random access nonvolatile memory. The 28F020 adds electrical chip-erasure and reprogramming to familiar EPROM technology. Memory contents can be rewritten: in a test socket; in a PROM-programmer socket; on-board during subassembly test; in-system during final test; and in-system after-sale. The 28F020 increases memory flexibility, while contributing to time- and cost-savings.

Intel

The 28F020 is a 2048-kilobit nonvolatile memory organized as 262,144 bytes of 8 bits. Intel's 28F020 is offered in 32-pin plastic DIP, 32-lead PLCC, and 32-lead TSOP packages. Pin assignments conform to JEDEC standards for byte-wide EPROMs.

Extended erase and program cycling capability is designed into Intel's ETOX™ II (EPROM Tunnel Oxide) process technology. Advanced oxide processing, an optimized tunneling structure, and lower electric field combine to extend reliable cycling beyond that of traditional EEPROMs. With the 12.0V V_{PP} supply, the 28F020 performs a minimum of 10,000 erase and program cycles well within the time limits of the Quick-Pulse Programming and Quick-Erase algorithms.

Intel's 28F020 employs advanced CMOS circuitry for systems requiring high-performance access speeds, low power consumption, and immunity to noise. Its 150 nanosecond access time provides no-WAIT-state performance for a wide range of microprocessors and microcontrollers. Maximum standby current of 100 μA translates into power savings when the device is deselected. Finally, the highest degree of latch-up protection is achieved through Intel's unique EPI processing. Prevention of latch-up is provided for stresses up to 100 mA on address and data pins, from $-1V$ to $V_{CC} + 1V$.

With Intel's ETOX II process base, the 28F020 levers years of EPROM experience to yield the highest levels of quality, reliability, and cost-effectiveness.

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PRELIMINARY

28F001BX-T/28F001BX-B
1M (128K x 8) CMOS FLASH MEMORY

- **High Integration Blocked Architecture**
  - **One 8KB Boot Block w/Lock Out**
  - **Two 4KB Parameter Blocks**
  - **One 112KB Main Block**
- **10,000 Erase/Program Cycles Minimum Per Block**
- **Simplified Program and Erase**
  - **Automated Algorithms via On-Chip Write State Machine (WSM)**
- **SRAM-Compatible Write Interface**
- **Deep-Powerdown Mode**
  - **0.05 μA I_{CC} Typical**
  - **0.8 μA I_{PP} Typical**
- **12.0V $\pm$5% V_{PP}**
- **High-Performance Read**
  - **120 ns Maximum Access Time**
  - **5.0V $\pm$10% V_{CC}**
- **Hardware Data Protection Feature**
  - **Erase/Write Lockout during Power Transitions**
- **Advanced Packaging, JEDEC Pinouts**
  - **32-Pin PDIP**
  - **32-Lead PLCC, TSOP**
- **ETOX™ II Nonvolatile Flash Technology**
  - **EPROM-Compatible Process Base**
  - **High-Volume Manufacturing Experience**

Intel's 28F001BX-B and 28F001BX-T combine the cost-effectiveness of Intel standard Flash Memory with features that simplify write and allow block erase. These devices aid the system designer by combining the functions of several components into one, making boot block flash an innovative alternative to EPROM and EEPROM or battery-backed static RAM. Many new and existing designs can take advantage of the 28F001BX's integration of blocked architecture, automated electrical reprogramming, and standard processor interface.

The 28F001BX-B and 28F001BX-T are 1,048,576-bit nonvolatile memories organized as 131,072 bytes of 8 bits. They are offered in 32-pin plastic DIP, 32-lead PLCC and 32-lead TSOP packages. Pin assignment conform to JEDEC standards for byte-wide EPROMs. These devices use an integrated command port and state machine for simplified block erasure and byte reprogramming. The 28F001BX-T's block locations provide compatibility with microprocessors and microcontrollers that boot from high memory, such as Intel's MCS-186 family, 80286, i386™, i486™, i860™ and 80960CA. With exactly the same memory segmentation, the 28F001BX-B memory map is tailored for microprocessors and microcontrollers that boot from low memory, such as Intel's MCS-51, MCS-196, 80960KX and 80960SX families. All other features are identical, and unless otherwise noted, the term 28F001BX can refer to either device throughout the remainder of this document.

The boot block section includes a reprogramming write lock out feature to guarantee data integrity. It is designed to contain secure code which will bring up the system minimally and download code to the other locations of the 28F001BX. Intel's 28F001BX employs advanced CMOS circuitry for systems requiring high-performance access speeds, low power consumption, and immunity to noise. Its 120 ns access time provides no-WAIT-state performance for a wide range of microprocessors and microcontrollers. A deep-powerdown mode lowers power consumption to 0.25 μW typical through V_{CC}, crucial in laptop computer, handheld instrumentation and other low-power applications. The $\overline{PWD}$ power control input also provides absolute data protection during system powerup or power loss.

Manufactured on Intel's 1-micron ETOX II process base, the 28F001BX builds on years of EPROM experience to yield the highest levels of quality, reliability, and cost-effectiveness.

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PEEL™22CV10A-7
CMOS Programmable Electrically Erasable Logic Device

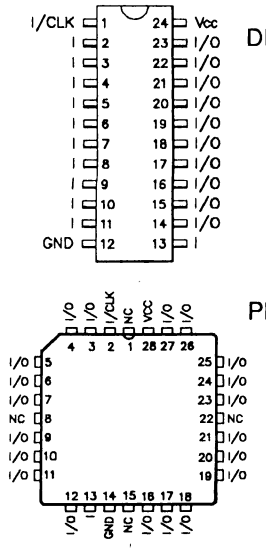
Features

- **Advanced CMOS EEPROM Technology**
- **Ultra High Performance**
  - 7.5ns (t_{PD})
  - f_{max} as fast as 133.3 Mhz
- **Low Power Consumption**
  - 110mA + 0.5mA/MHz max
- **EE Reprogrammability**
  - Low-risk reprogrammable inventory
  - Superior programming and functional yield
  - Erases and programs in seconds
- **Development and Programming Support**
  - Third-party software and programmers
  - ICT PEEL Development System and software.
- **Architectural Flexibility**
  - 132 product term x 44 input AND array
  - Up to 22 inputs and 10 outputs
  - Variable product term distribution (8 to 16 per output) for greater logic flexibility
  - Independently programmable I/O macrocells
  - Synchronous preset, asynchronous clear
  - Independently programmable output enables
- **Application Versatility**
  - Replaces random SSI/MSI logic
  - Pin-compatible with the bipolar AmPAL22V10 and CMOS PALC22V10

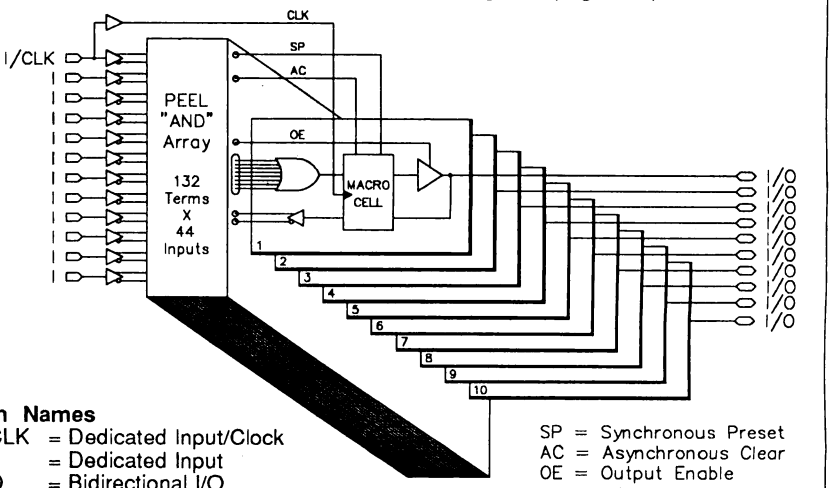
General Description

The ICT PEEL22CV10A-7 is a CMOS Programmable Electrically Erasable Logic Device that provides a high-performance, low-power, reprogrammable, and architecturally enhanced alternative to current generation programmable logic devices (PLDs). Designed in advanced CMOS EEPROM technology, the PEEL22CV10A-7 rivals speed parameters of comparable bipolar PLDs while providing a dramatic improvement in active power consumption. The EE reprogrammability of the PEEL22CV10A-7 allows cost effective plastic packaging, low risk inventory, reduced development and retrofit costs, and enhanced testability to ensure 100% field programmability and function. The PEEL22CV10A-7's flexible architecture offers complete function and JEDEC-file compatibility with the bipolar AmPAL22V10 and the CMOS PALC22V10. Applications for the PEEL22CV10A-7 include: replacement of random SSI/MSI logic circuitry and user customized sequential and combinatorial functions such as counters, shift registers, state machines, address decoders, multiplexers, etc. Development and programming support for the PEEL22CV10A-7 is provided by ICT and third-party manufacturers.

Pin Configuration (Figure 1)



Block Diagram (Figure 2)



Pin Names

I/CLK	= Dedicated Input/Clock
I	= Dedicated Input
I/O	= Bidirectional I/O
GND	= Ground
Vcc	= Power Supply

SP = Synchronous Preset
AC = Asynchronous Clear
OE = Output Enable

TN 0000005 EYN 9.5.1 rev. A 5/5

ICT, Inc.

INC.

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PA7024, PA7140 and PA7128 PEEL™ Array
CMOS Programmable Electrically Erasable Logic Array

Features

User-Configurable High Density Logic Array
- — Create multi-level I/O-buried logic circuits
- — Over 80/96 sum-of-products functions
- — 24/28/40 pin packages (PA7024/7128/7140)
- — 1200/1700 gate equivalency

CMOS EE-Technology
- — Low power, ICC=120mA+0.5mA/MHz
- — Reprogrammable in plastic package
- — Low risk inventory, superior factory testing

High Performance
- — Wide-gate functions in single level delays
- — tpd = 13ns/20ns (internal/external)
- — Freq = up to 58.8MHz

Flexible Architecture
- — Input registers and latches
- — I/O buried D, T and JK registers with independent clock, preset and reset
- — Separate output enables per I/O

Logic Integration and Customization of:
- — PLDs, SSI/MSI, random logic, decoders, encoders, muxs, comparators, shifters, counters, state machines, etc.

Simplified Development Methodology
- — Predictable symmetrical timing, no routing
- — Complete design with PLACE™ Software and PEEL Development System from ICT

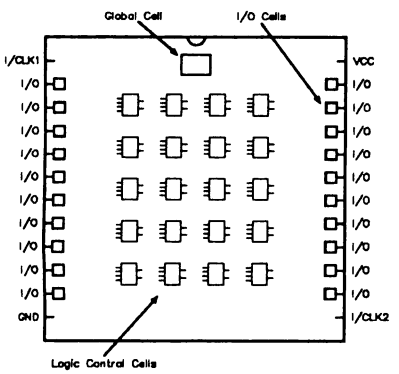
General Description

The PA7024, PA7128 and PA7140 are user-configurable high-density Programmable Electrically Erasable Logic (PEEL) Arrays for creating multi-level, I/O-buried, logic circuits. Designed in ICTs advanced 1-micron CMOS EE-technology, the PA7024/128/140 offer low power consumption, high speed performance, and reprogrammability in plastic packaging allowing superior factory testing and a low risk re-usable inventory. The PA7024/128/140's wide-gate architecture can implement complex combinatorial and sequential functions within single-level delays as fast as 13ns (internal) and at clock rates of 58MHz.

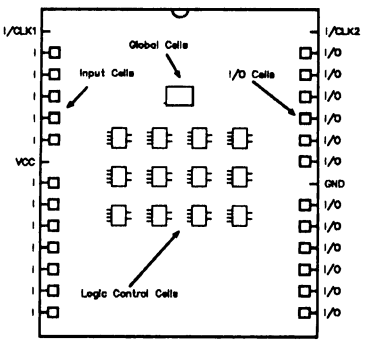
Flexible architectures offer; input reg/latches per I/O, buried D, T, or JK registers with independent clock, preset and reset, and separate output enables. This versatility makes the PA7024/40/128 ideal for integrating SSI/MSI, multiple PLDs and customizing random logic, decoders, muxs, comparators, shifters, counters, state machines, etc. Extensive signal interconnectivity makes all timing paths symmetrical, simplifying design with predictable performance and the elimination of gate-array-like routing. Complete development and programming support is provided by ICTs PLACE Software and PEEL Development System.

ICT, Inc.

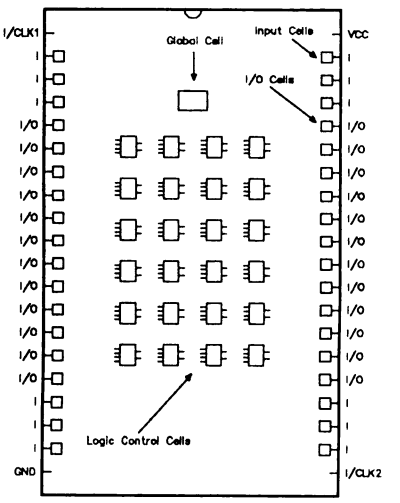
7024 Block Diagram



7128 Block Diagram



7140 Block Diagram



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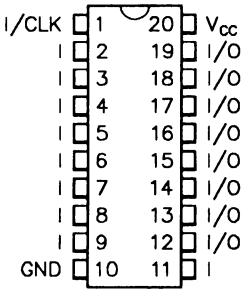
PEEL™ Family of EEPLDs

PEEL™ devices (Programmable Electrically Erasable Logic devices), combine CMOS and EEPROM technologies to offer an attractive alternative to early-generation PLDs. PEEL devices eliminate PLD design tradeoffs by providing a balance of features most needed by logic designers today.

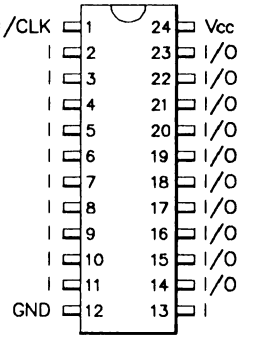
- **PEEL CMOS Performance** provides lower power consumption, lower operating temperature, and higher reliability than bipolar PLDs.
- **PEEL Architectural Flexibility** allows a few PEEL devices to replace over 40 different PLD architectures, simplifying inventory management. Enhancements, including more product terms, in dependent output enables, and a 12-configuration I/O macrocell make it possible to put more logic in each package.
- **PEEL Ease of Design** is provided by ICT's free PEEL development software, a low cost PEEL development system (PDS-1) and support from popular programmers.
- **PEEL EE-Reprogrammability** provides the convenience of in stant reprogramming for development. There is no waste, as with one-time-programmable PLDs, and no wait, as with UV-erasable PLDs. It also provides a risk-free reusable production inventory minimizing the impacts of programming changes or errors.
- **PEEL High Quality** is a result of 100 percent testable PEEL tech nology. PEEL devices are shipped with a 50ppm Average Out going Quality Level (including programming and function) as compared to greater than 10,000ppm with bipolar PLDs.
- **PEEL Cost Effectiveness** because there are no hidden over head costs as with bipolar PLDs, such as program/test yield loss, mUL multiple-device inventories, reject administration, and board and field failure rework.

PEEL™ is a trademark of ICT, INC.

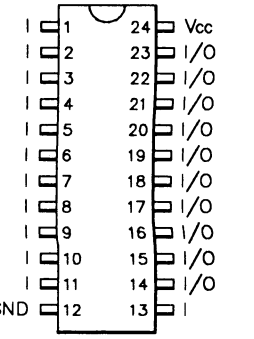
PEEL18CV8



PEEL22CV10(Z)/PEEL20CG10



PEEL173/PEEL273



	ARCHITECTURE							SPEED	POWER
Superset	**Pins**	**Inputs**	**I/Os**	**Registers**	**Macro Configs**	**Prog. Arrays**	**Product / Sum Terms**	**Prop Delay (nS) t_{PD}**	**Supply Current**
PEEL 18CV8	20	10	8	8	12	AND	74	10/15/20	80+0.7/MHz
PEEL18CV8	20	10	8	8	12	AND	74	25/35	20+0.5/MHz
PEEL20CG10A	24	12	10	10	12	AND	92	10/12/15	100+0.5/MHz
PEEL20CG10	24	12	10	10	12	AND	92	20/25/35	55+0.5/MHz
PEEL22CV10A	24	12	10	10	4/12	AND	132	7.5/10/12/15	100+0.5/MHz
PEEL22CV10	24	12	10	10	4/12	AND	132	20/25/35	55+0.5/MHz
PEEL22CV10Z	24	12	10	10	12	AND	132	20/25/35	55+0.5/MHz
PEEL173	24	12	10	N/A	N/A	AND/OR	42/10	15	60+0.5/MHz
PEEL173	24	12	10	N/A	N/A	AND/OR	42/10	30/35	35+1.0/MHz
PEEL273	24	12	10	N/A	N/A	AND/OR	42/10	15	60+0.5/MHz
PEEL273	24	12	10	N/A	N/A	AND/OR	42/10	30/35	35+1.0/MHz

The PEEL22CV10Z offers a user-selectable "zero-power" standby mode where I_{CC} = 200µA

ICT, Inc.

INC.

2125 Lundy Ave.
San Jose CA 95131
Tel (408) 434-0678
Fax (408) 434-0688

CMOS High Speed EPROMs

Features

- **Advanced CMOS EPROM Technology**
- **High Performance**
  - — 27CX010 - 45-70ns access times
  - — 27CX256 - 35-55ns access times
- **Low Power Consumption**
  - — 90mA Max Active
  - — 20mA Max Standby, TTL interface
  - — 1mA Max Standby, CMOS interface
- **TTL-Compatible I/O**
- **Reprogrammability**
  - — Adds convenience, reduces costs
  - — Windowed package for UV erasure
  - — Allows 100 % factory testing
- **Programming Support**
  - — Supported by popular programmers
  - — Fast programming algorithm
  - — Auto Select mode feature
- **Packaging**
  - — JEDEC-standard 32-pin CERDIP
  - — Pin compatible upgrades from 512K through 8M-bits

General Description

The high-speed and high-density EPROMs are ideal for operation with fast 16-bit and 32-bit microprocessors, eliminating the necessity of wait states without using cashe static RAM. Available in JEDEC-standard 28-pin and 32-pin packages, the 27CX256 and 27CX010 allow pin-compatible upgrades through 8M-bit EPROMS with minimal or no hardware changes. The 27CX256 and 27CX010 are designed using advanced CMOS EPROM technology which provides ultra-fast access times (40-90ns max) and a low active power consumption (90mA max). The power consumption is further reduced (1mA max) with its special CMOS standby mode, when pin $\overline{CE}$ is deselected. An Auto Select mode provides for foolproof programmer operation by allowing EPROM programmers to read a special code from the 27CX010 and 27CX256 to identify manufacturer and part type.

ICT, Inc.

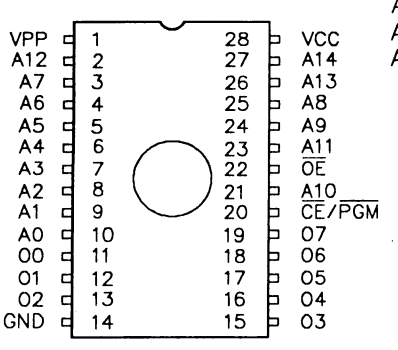
Pin Configuration

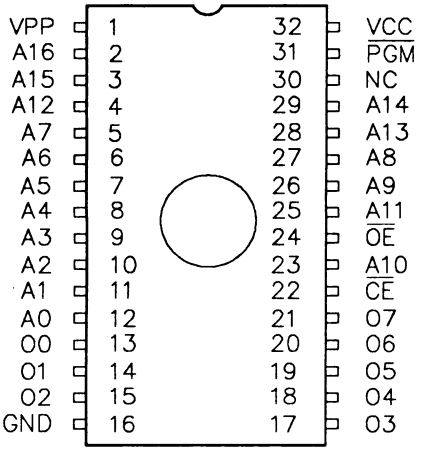
27CX256 (600mil)

27CX010 (600mil)

Pin Names

A0–A16	Address Inputs
$\overline{O0}$–O7	Data Outputs
$\overline{CE}$	Chip Enable
$\overline{OE}$	Output Enable
$\overline{PGM}$	Program
GND	Ground
Vcc	Power Supply





The Krueger Company

1544 WEST MINERAL ROAD
TEMPE, ARIZONA 85283

(602) 820-5330 • (800) 245-2235
FAX (602) 820-1707

Krueger Company

The KRUEGER COMPANY developed a patented process (*the KRUEGER infrared process*) to remove integrated circuits from PC boards without thermally damaging or degrading them. After removal ICs are completely refurbished and the customer is provided a product as good as new. The KRUEGER process minimizes the rate of change of temperature actually experienced by the silicon device. The refurbishment includes removal of oxidation, corrosion or contamination from the leads of the device, retinning the leads, straightening the leads and orienting the ICs in new antistatic tubes. EPROMs are cleaned and erased. Parts are sorted by commercial part number and manufacturer. Surface mount, DIP and ZIP packages are all routinely processed. DIP and ZIP packages with trimmed leads can be recovered as good usable parts for manual insertion into boards or sockets.

The KRUEGER COMPANY has provided the electronics industry with the benefits of the KRUEGER process in the form of high quality refurbished ICs in two ways.

1. The KRUEGER COMPANY offers a component retrieval service which enables the IC user to recover and reuse any IC or other component on existing PC boards. The KRUEGER COMPANY retrieval service offers the electronics industry a way to obtain needed parts at a small fraction of their cost and lead time while helping gain maximum value from obsolete boards.
2. The KRUEGER COMPANY also obtains boards from which parts are retrieved, refurbished and made available to IC purchasers worldwide. The KRUEGER COMPANY maintains an inventory of refurbished ICs and may well be able to supply your immediate needs for any category of IC.

The list below is a typical example of parts commonly available from KRUEGER COMPANY.

Dynamic RAMs	PsuedoStatic RAMs		EPROMs	Processors/other	
511000	658128	65256	27210	68020	8088
514256	**Static RAMs**		27010	68010	8087
41256			27512	68000	8086
41264 VIDEO			27256	68030	8085
4464	62256	6288	27128	68882	8080
4164	6264	4801	68766	68881	Z80
4416	6116	2147	2764	80286	146818
4116	2128	2148	2732	80186	48C02
ALL MODES	6167	2149	2532	80287	16450
AVAILABLE	6168	2114	2716	80386	8250
			2708		

Lansdale Semiconductor, Inc.

2929 S. 48th St., Suite #2
Tempe, AZ 85282
Phone: (602)438-0123
Fax: (602)438-0138

Lansdale Semiconductor, Inc., is an integrated circuit manufacturer specializing in diminished source military products. Lansdale is capable of supplying both MIL-STD-883 compliant and High Reliability military processed products. Custom processing is available upon request.

The following is a partial cross-reference to Lansdale product available as of 10/1/91. It is organized by original manufacturer and shows the Lansdale replacement for each part listed. If there is a product you need but do not see on the list, contact Lansdale or your Lansdale Representative to determine if it has been recently acquired, has a Lansdale alternative, or can be specially manufactured for you.

AMD

Original P/N	Lansdale P/N
AM2501	AL2501
AM2506	AL2506
AM2905	AL2905
AM2906	AL2906
AM2915	AL2915
AM8T26	AL8T26

FAIRCHILD

Original P/N	Lansdale P/N
3262A	FL3262A
3262B	FL3262B
3341	FL3341
3341A	FL3341A
3342	FL3342
3348	FL3348
3349	FL3349
3351	FL3351
3357	FL3357
3708	FL3708
4609	FL4609
4611	FL4611
54198	FL54198
54H08	FL54H08

HARRIS

Original P/N	Lansdale P/N
HPROM-0512	HL0512
HD-6600	HL6600
HDI-234	HL234
HD-245	HL245
HD-246	HL246
HD-248	HL248
HM-0104	HL0104
HM-0168	HL0168
HM-0186	HL0186
HM-0198	HL0198
HM-0410	HL0410
HM-7602	HL7602
HM-7603	HL7603
HM-7610	HL7610
HM-7610A	HL7610A
HM-7610B	HL7610B
HM-7611	HL7611
HM-7611A	HL7611A
HM-7611B	HL7611B
HM-7620	HL7620
HM-7620A	HL7620A
HM-7620B	HL7620B
HM-7621	HL7621
HM-7621A	HL7621A
HM-7621B	HL7621B
HM-7640	HL7640
HM-7640A	HL7640A
HM-7641	HL7641
HM-7641A	HL7641A
HM-7642	HL7642
HM-7642A	HL7642A
HM-7642B	HL7642B
HM-7643	HL7643
HM-7643A	HL7643A
HM-7643B	HL7643B
HM-7649	HL7649
HM-7649A	HL7649A
HM-7681	HL7681
HM-7681A	HL7681A
HM-7685	HL7685
HM-7685A	HL7685A
HM-76161	HL76161
HM-76161A	HL76161A
HM-76161B	HL76161B
HM-76165	HL76165
HM-76321	HL76321
HM-76641	HL76641
HM-76641A	HL76641A

INTEL

Original P/N	Lansdale P/N
M8080A	IL8080A
M8212	IL8212
M8214	IL8214
M8216	IL8216
M8224	IL8224
M8226	IL8226
M8228	IL8228
M8282	IL8282
M8283	IL8283
M8286	IL8286
M8287	IL8287
M8289	IL8289

MOTOROLA

SUHL/TTL

Original P/N	Lansdale P/N
MC400	ML400
MC401	ML401
MC402	ML402
MC403	ML403
MC404	ML404
MC405	ML405
MC406	ML406
MC407	ML407
MC408	ML408
MC409	ML409
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Original P/N	Lansdale P/N
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RTL	
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MC998	ML998
MC999	ML999
MC9801	ML9801
MC9802	ML9802

Original P/N	Lansdale P/N
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MC946	ML946
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MC1918	ML1918
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MC1217	ML1217
MC1226	ML1226
MC1239	ML1239
LINEAR	
MC1503	ML1503
MC1510	ML1510
MC1512	ML1512
MC1520	ML1520
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MC1533	ML1533
MC1535	ML1535
MC1538	ML1538
MC1552	ML1552
MC1553	ML1553
MC1561	ML1561
MC1710	ML1710
TTL II	
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MC2001	ML2001
MC2002	ML2002

Original P/N	Lansdale P/N
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MC2004	ML2004
MC2005	ML2005
MC2006	ML2006
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MC2012	ML2012
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MC2016	ML2016
MC2018	ML2018
MC2023	ML2023
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MC2155	ML2155
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MC2157	ML2157
MC2159	ML2159
MC2161	ML2161
MC2162	ML2162
MC2163	ML2163
MC2165	ML2165
MC2166	ML2166
MC2168	ML2168

Lansdale Semiconductor

Original P/N	Lansdale P/N
MC2173	ML2173
MC2174	ML2174
MC2175	ML2175
MC2176	ML2176
MC2178	ML2178
TTL III	
MC3000	ML3000
MC3001	ML3001
MC3002	ML3002
MC3003	ML3003
MC3004	ML3004
MC3005	ML3005
MC3006	ML3006
MC3007	ML3007
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MC3011	ML3011
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MC3101	ML3101
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MC3104	ML3104
MC3105	ML3105
MC3106	ML3106
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MC3110	ML3110
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MC3115	ML3115
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MC3119	ML3119
MC3120	ML3120
MC3121	ML3121
MC3122	ML3122

Original P/N	Lansdale P/N
MC3123	ML3123
MC3124	ML3124
MC3125	ML3125
MC3126	ML3126
MC3128	ML3128
MC3129	ML3129
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MC3133	ML3133
MC3134	ML3134
MC3150	ML3150
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MC3154	ML3154
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MC3160	ML3160
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MC3162	ML3162
MC3163	ML3163
MC3164	ML3164
TTL	
MC4000	ML4000
MC4001	ML4001
MC4002	ML4002
MC4004	ML4004
MC4005	ML4005
MC4006	ML4006
MC4007	ML4007
MC4008	ML4008
MC4010	ML4010
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MC4016	ML4016
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MC4018	ML4018
MC4019	ML4019
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MC4058	ML4058
MC4060	ML4060
MC4062	ML4062
MC4064	ML4064

Original P/N	Lansdale P/N
MC4068	ML4068
MC4300	ML4300
MC4301	ML4301
MC4302	ML4302
MC4304	ML4304
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MC4307	ML4307
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MC4316	ML4316
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MC4323	ML4323
MC4326	ML4326
MC4327	ML4327
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MC4332	ML4332
MC4335	ML4335
MC4337	ML4337
MC4338	ML4338
MC4339	ML4338
MC4340	ML4340
MC4341	ML4341
MC4342	ML4342
MC4343	ML4343
MC4350	ML4350
MC4351	ML4351
MC4352	ML4352
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MC4354	ML4354
MC4355	ML4355
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MC4358	ML4358
MC4360	ML4360
MC4362	ML4362
MC4364	ML4364
MC4368	ML4368
TTL-SUHL II	
MC5090	ML5090
MC5092	ML5092
MC5111	ML5111
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MC5121	ML5121
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MC5131	ML5131
MC5133	ML5133
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MC5153	ML5153
MC5163	ML5163
MC5171	ML5171
MC5181	ML5181
MC5183	ML5183
MC5191	ML5191
MC5193	ML5193

Original P/N	Lansdale P/N
TTL	
MC5400	ML5400
MC5401	ML5401
MC5402	ML5402
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MC5441A	ML5441A
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MC5442A	ML5442A
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MC5486	ML5486
MC5490	ML5490
MC5490A	ML5490A
MC5491A	ML5491A
MC5492	ML5492
MC5492A	ML5492A
MC5493	ML5493
MC5493A	ML5493A
MC5494	ML5494
MC5495	ML5495
MC5495A	ML5495A
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MC54298	ML54298
MC15482	ML15482
MC25482	ML25482
MC7400	ML7400
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MC7402	ML7402
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MC7490	ML7490
MC7490A	ML7490A
MC7491A	ML7491A
MC7492	ML7492
MC7492A	ML7492A
MC7493	ML7493
MC7493A	ML7493A
MC7494	ML7494
MC7495	ML7495
MC7495A	ML7495A
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MC74100	ML74100
MC74107	ML74107
MC74120	ML74120
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MC74122	ML74122
MC74123	ML74123
MC74128	ML74128
MC74132	ML74132
MC74136	ML74136
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MC74145	ML74145
MC74150	ML74150
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MC74152	ML74152
MC74153	ML74153
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MC74155	ML74155
MC74156	ML74156
MC74160	ML74160
MC74161	ML74161
MC74162	ML74162
MC74163	ML74163

Original P/N	Lansdale P/N
MC74164	ML74164
MC74164A	ML74164A
MC74165	ML74165
MC74166	ML74166
MC74167	ML74167
MC74174	ML74174
MC74175	ML74175
MC74176	ML74176
MC74177	ML74177
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MC74196	ML74196
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MC74279	ML74279
MC74290	ML74290
MC74293	ML74293
MC74298	ML74298
MC17482	ML17482
MC27482	ML27482
TTL III	
MC54H00	ML54H00
MC54H01	ML54H01
MC54H02	ML54H02
MC54H04	ML54H04
MC54H05	ML54H05
MC54H08	ML54H08
MC54H10	ML54H10
MC54H11	ML54H11
MC54H12	ML54H12
MC54H20	ML54H20
MC54H21	ML54H21
MC54H22	ML54H22
MC54H28	ML54H28
MC54H29	ML54H29
MC54H30	ML54H30
MC54H31	ML54H31
MC54H32	ML54H32
MC54H36	ML54H36
MC54H39	ML54H39
MC54H40	ML54H40
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MC54H61	ML54H61
MC54H62	ML54H62
MC54H71	ML54H71
MC54H72	ML54H72
MC54H73	ML54H73
MC54H74	ML54H74
MC54H79	ML54H79
MC54H86	ML54H86
MC54H87	ML54H87
MC54H89	ML54H89

Original P/N	Lansdale P/N
MC54H101	ML54H101
MC54H102	ML54H102
MC54H103	ML54H103
MC54H108	ML54H108
MC54H116	ML54H116
MC54H117	ML54H117
MC54H119	ML54H119
MC54H120	ML54H120
MC74H00	ML74H00
MC74H01	ML74H01
MC74H02	ML74H02
MC74H04	ML74H04
MC74H05	ML74H05
MC74H08	ML74H08
MC74H10	ML74H10
MC74H11	ML74H11
MC74H12	ML74H12
MC74H20	ML74H20
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MC74H22	ML74H22
MC74H28	ML74H28
MC74H29	ML74H29
MC74H30	ML74H30
MC74H31	ML74H31
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MC74H62	ML74H62
MC74H71	ML74H71
MC74H72	ML74H72
MC74H73	ML74H73
MC74H74	ML74H74
MC74H79	ML74H79
MC74H86	ML74H86
MC74H87	ML74H87
MC74H89	ML74H89
MC74H101	ML74H101
MC74H102	ML74H102
MC74H103	ML74H103
MC74H108	ML74H108
MC74H116	ML74H116
MC74H117	ML74H117
MC74H119	ML74H119
MC74H120	ML74H120
TTL	
MC7200	ML7200
MC7201	ML7201
MC7202	ML7202
MC7203	ML7203
MC7233	ML7233
MC7234	ML7234
MC7235	ML7235
MC7241	ML7241
MC7242	ML7242
MC7250	ML7250
MC7251	ML7251
MC7260	ML7260
MC7261	ML7261
MC7266	ML7266

Original P/N	Lansdale P/N
MC7267	ML7267
MC7270	ML7270
MC7271	ML7271
MC7280	ML7280
MC7281	ML7281
MC7284	ML7284
MC7285	ML7285
MC7288	ML7288
MC7290	ML7290
MC7291	ML7291
MC8200	ML8200
MC8201	ML8201
MC8202	ML8202
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MC8233	ML8233
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MC8241	ML8241
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MC8250	ML8250
MC8251	ML8251
MC8260	ML8260
MC8261	ML8261
MC8266	ML8266
MC8267	ML8267
MC8270	ML8270
MC8271	ML8271
MC8280	ML8280
MC8281	ML8281
MC8284	ML8284
MC8285	ML8285
MC8288	ML8288
MC8290	ML8290
MC8291	ML8291
TTL	
MC8300	ML8300
MC8301	ML8301
MC8304	ML8304
MC8306	ML8306
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MC8308	ML8308
MC8309	ML8309
MC8310	ML8310
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MC8317	ML8317
MC8318	ML8318
MC8322	ML8322
MC8324	ML8324
MC8328	ML8328
MC8601	ML8601
MC8602	ML8602
MC9300	ML9300
MC9301	ML9301
MC9304	ML9304
MC9306	ML9306
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MC9309	ML9309
MC9310	ML9310
MC9311	ML9311
MC9312	ML9312
MC9314	ML9314
MC9316	ML9316
MC9317	ML9317
MC9318	ML9318

Original P/N	Lansdale P/N
MC9322	ML9322
MC9324	ML9324
MC9328	ML9328
MC9601	ML9601
MC9602	ML9602

NATIONAL

DM75L54	NL75L54

RAYTHEON

DTL

RM201	RL201
RM202	RL202
RM204	RL204
RM206	RL206
RM208	RL208
RM210	RL210
RM211	RL211
RM212	RL212
RM213	RL213
RM214	RL214
RM215	RL215
RM216	RL216
RM217	RL217
RM220	RL220
RM221	RL221
RM224	RL224
RM225	RL225
RM226	RL226
RM227	RL227
RM231	RL231
RM234	RL234
RM236	RL236
RM241	RL241
RM246	RL246
RM261	RL261
RM266	RL266
RM286	RL286
RM288	RL288
RM296	RL296

DTL

RM930	ML930
RM932	ML932
RM933	ML933
RM934	ML934
RM935	ML935
RM936	ML936
RM937	ML937
RM939	ML939
RM940	ML940
RM941	ML941
RM944	ML944
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RM950	ML950
RM951	ML951
RM957	ML957
RM958	ML958
RM961	ML961
RM962	ML962
RM963	ML963
RM993	ML953
RM994	ML956
RM997	ML955
RM999	ML952

TTL

RM8200	SL8200
RM8201	SL8201
RM8203	SL8203
RM8230	SL8230
RM8231	SL8231
RM8232	SL8232
RM8241	SL8241
RM8242	SL8242
RM8243	SL8243
RM8250	SL8250
RM8251	SL8251
RM8252	SL8252
RM8260	SL8260
RM8261	SL8261
RM8263	SL8263
RM8264	SL8264
RM8267	SL8267
RM8270	SL8270
RM8274	SL8274
RM8275	SL8275
RM8277	SL8277
RM8280	SL8280
RM8281	SL8281
RM8284	SL8284
RM8285	SL8285
RM8290	SL8290
RM8291	SL8291
RM8293	SL8293

TTL - SUHL

RF30	ML521
RF31	ML571
RF50	ML515
RF51	ML565
RF60	ML516
RF61	ML566
RF100	ML523
RF101	ML573
RF110	RL110
RF111	ML574
RF120	ML2123
RF121	ML2173
RF130	ML2124
RF131	ML2174
RF200	ML2125
RF201	ML2175
RF210	ML2126
RF211	ML2176
RF230	ML2075
RF250	ML2109
RF251	ML2159
RF9601	ML9601

TTL-SUHL

RG40	ML500
RG41	ML550
RG50	ML501
RG51	ML551
RG60	ML502
RG61	ML552
RG70	ML520
RG71	ML570
RG80	ML526
RG81	ML576
RG83	ML476
RG90	ML503
RG91	ML553
RG110	ML505
RG111	ML555
RG120	ML506
RG121	ML556
RG130	ML507
RG131	ML557
RG140	ML508
RG141	ML558
RG150	ML509
RG151	ML559
RG160	ML519
RG161	ML569
RG170	ML510
RG171	ML560
RG180	ML511
RG181	ML561
RG190	ML512
RG191	ML562
RG200	ML2111
RG201	ML2161
RG210	ML2100
RG211	ML2150
RG220	ML2101
RG221	ML2151
RG223	ML2051
RG230	ML2102
RG231	ML2152
RG240	ML2103
RG241	ML2153
RG250	ML2104
RG251	ML2154
RG260	ML2105
RG261	ML2155
RG270	ML2106
RG271	ML2156
RG280	ML527
RG281	ML577
RG290	ML528
RG291	ML578
RG300	ML2112
RG301	ML2162
RG310	ML2113
RG311	ML2163
RG320	ML2107
RG321	ML2157
RG330	RL330
RG331	RL331
RG340	RL340
RG341	RL341
RG370	ML529
RG371	ML579
RG380	ML2116
RG381	ML2166
RG7520	ML2165
RG7521	ML2165

TTL-SUHL

RL10	ML4326
RL11	ML4327
RL20	ML4328
RL21	ML4329
RL30	ML4330
RL31	ML4331

Original P/N	Lansdale P/N
RL40	ML4332
RL61	ML4335
RL71	ML4337
RL80	ML4304
RL81	ML4305

SIGNETICS

DTL

SE101	SL101
SE102	SL102
SE105	SL105
SE106	SL106
SE110	SL110
SE111	SL111
SE112	SL112
SE113	SL113
SE115	SL115
SE116	SL116
SE124	SL124
SE125	SL125
SE150	SL150
SE155	SL155
SE156	SL156
SE157	SL157
SE160	SL160
SE161	SL161
SE162	SL162
SE170	SL170
SE180	SL180
SE181	SL181
SE415	SL415
SE416	SL416
SE417	SL417
SE440	SL440
SE455	SL455
SE470	SL470
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SE490	SL490
SE511	SL511
SE526	SL526
SE616	SL616
SE620	SL620
SE629	SL629
SE631	SL631
SE659	SL659
SE670	SL670
SE680	SL680
SE690	SL690
CS700	SL700
CS701	SL701
CS704	SL704
CS709	SL709
CS716	SL716
CS720	SL720
CS721	SL721
CS727	SL727
CS729	SL729
CS730	SL730
CS731	SL731
CS732	SL732
S8162	SL8162
S8415	SL8415
S8416	SL8416
S8417	SL8417
S8440	SL8440
S8455	SL8455
S8470	SL8470
S8471	SL8471
S8480	SL8480
S8481	SL8481
S8490	SL8490

UTILOGIC II

SP300	SL300
SP301	SL301
SP302	SL302
SP304	SL304
SP305	SL305
SP306	SL306
SP314	SL314
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SP377	SL377
SP380	SL380
SP381	SL381
SP384	SL384
SP387	SL387
SP391	SL391
SP3271	SL3271
SP3280	SL3280
SP3281	SL3281

TTL

S5401	SL5401
S5402	SL5402
S5409	SL5409
S5447	SL5447
S5448	SL5448
S5453	SL5453
S5454	SL5454
S5460	SL5460
S5470	SL5470
S5472	SL5472
S5480	SL5480
S54100	SL54100
S54152	SL54152
S54182	SL54182
S54198	SL54198
N7401	SL7401
N7402	SL7402
N7409	SL7409
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N7448	SL7448
N7453	SL7453
N7454	SL7454
N7460	SL7460
N7470	SL7470
N7472	SL7472
N7480	SL7480
N74100	SL74100
N74152	SL74152
N74182	SL74182
N74198	SL74198

TTL III

S54H00	SL54H00
S54H01	SL54H01
S54H08	SL54H08
S54H10	SL54H10
S54H11	SL54H11
S54H20	SL54H20
S54H21	SL54H21
S54H22	SL54H22
S54H30	SL54H30
S54H40	SL54H40
S54H52	SL54H52
S54H53	SL54H53
S54H54	SL54H54
S54H55	SL54H55
S54H60	SL54H60
S54H61	SL54H61
S54H62	SL54H62
S54H71	SL54H71
S54H72	SL54H72
S54H73	SL54H73
S54H74	SL54H74
S54H76	SL54H76
S54H101	SL54H101
S54H102	SL54H102
S54H103	SL54H103
S54H106	SL54H106
S54H108	SL54H108
N74H00	SL74H00
N74H01	SL74H01
N74H08	SL74H08
N74H10	SL74H10
N74H11	SL74H11
N74H20	SL74H20
N74H21	SL74H21
N74H22	SL74H22
N74H30	SL74H30
N74H40	SL74H40
N74H52	SL74H52
N74H53	SL74H53
N74H54	SL74H54
N74H55	SL74H55
N74H60	SL74H60
N74H61	SL74H61
N74H62	SL74H62
N74H71	SL74H71
N74H72	SL74H72
N74H73	SL74H73
N74H74	SL74H74
N74H76	SL74H76
N74H101	SL74H101
N74H102	SL74H102
N74H103	SL74H103
N74H106	SL74H106
N74H108	SL74H108

TTL - Interface

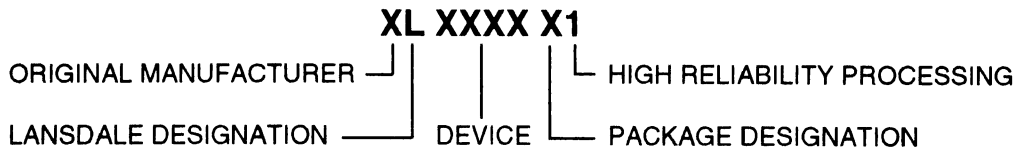
S8T04	SL8T04

Original P/N	Lansdale P/N
S8T05	SL8T05
S8T06	SL8T06
S8T10	SL8T10
S8T14	SL8T14
S8T15	SL8T15
S8T16	SL8T16
S8T18	SL8T18
S8T20	SL8T20
S8T24	SL8T24
S8T26	SL8T26
S8T28	SL8T28
S8T31	SL8T31
S8T32	SL8T32
S8T33	SL8T33
S8T35	SL8T35
S8T36	SL8T36
S8T80	SL8T80
S8T90	SL8T90
S8T96	SL8T96
S8T125	SL8T125
S8T126	SL8T126
S8T129	SL8T129
S8T245	SL8T245
S8T380	SL8T380
S8T3404	SL8T3404
TTL	
S8200	SL8200
S8201	SL8201
S8202	SL8202
S8203	SL8203
S8221	SL8221
S8230	SL8230
S8231	SL8231
S8232	SL8232
S8234	SL8234
S8235	SL8235
S8241	SL8241
S8242	SL8242
S8243	SL8243
S8250	SL8250
S8251	SL8251
S8252	SL8252
S8260	SL8260
S8261	SL8261
S8263	SL8263
S8264	SL8264
S8266	SL8266
S8267	SL8267
S8269	SL8269
S8270	SL8270
S8271	SL8271
S8273	SL8273
S8274	SL8274
S8275	SL8275
S8277	SL8277
S8280	SL8280
S8281	SL8281
S8284	SL8284
S8285	SL8285
S8288	SL8288
S8290	SL8290
S8291	SL8291
S8292	SL8292
S8293	SL8293
INTERFACE	
S8H16	SL8H16
S8H20	SL8H20
S8H21	SL8H21
S8H22	SL8H22
S8H70	SL8H70
S8H80	SL8H80
TTL	
S8806	SL8806
S8808	SL8808
S8815	SL8815
S8816	SL8816
S8819	SL8819
S8821	SL8821
S8822	SL8822
S8824	SL8824
S8825	SL8825
S8827	SL8827
S8828	SL8828
S8829	SL8829
S8840	SL8840
S8848	SL8848
S8855	SL8855
S8859	SL8859
S8870	SL8870
S8875	SL8875
S8879	SL8879
S8880	SL8880
S8881	SL8881
S8885	SL8885
S8889	SL8889
S96106	SL96106
TEXAS INSTRUMENTS	
SN54L47	TL54L47

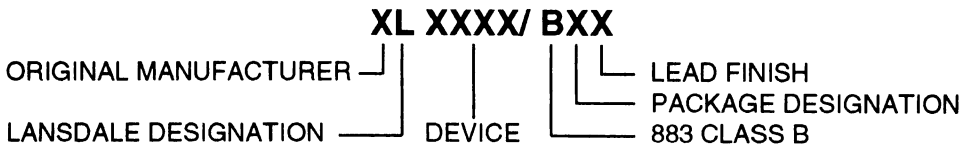
Lansdale Semiconductor

PART MARKING INFORMATION

STANDARD PARTS:



MIL-STD-883 COMPLIANT PARTS:



ORIGINAL MANUFACTURER INFORMATION

A	*	AMD
F	*	FAIRCHILD
H	*	HARRIS
I	*	INTEL
M	*	MOTOROLA
N	*	NATIONAL
R	*	RAYTHEON
S	*	SIGNETICS
T	*	TEXAS INSTRUMENTS

LEAD FINISH INFORMATION

A	*	SOLDER DIP
B	*	MATTE TIN
C	*	GOLD

PACKAGING INFORMATION

LETTER	MIL-M-38510 DESIGNATION	DESCRIPTION
A	F-1	14-LEAD FLAT PACK (1/4" X 1/4")
B	F-3	14-LEAD FLAT PACK (3/16" X 1/4")
C	D-1	14-LEAD DUAL INLINE (1/4" X 3/4")
D	F-2	14-LEAD FLAT PACK (1/4" X 3/8")
E	D-2	16-LEAD DUAL INLINE (1/4" X 7/8")
F	F-5	16-LEAD FLAT PACK (1/4" X 3/8")
G	A-1	8-LEAD CAN
H	F-4	10-LEAD FLAT PACK (1/4" X 1/4")
I	A-2	10-LEAD CAN
J	D-3	24-LEAD DUAL INLINE (1/2" X 1 1/4")
K	F-6	24-LEAD FLAT PACK (3/8" X 5/8")
L	D-9	24-LEAD DUAL INLINE (1/4" X 1 1/4")
M	A-3	12-LEAD CAN
P	D-4	8-LEAD DUAL INLINE (1/4" X 3/8")
Q	D-5	40-LEAD DUAL INLINE (9/16" X 2 1/16")
R	D-8	20-LEAD DUAL INLINE (1/4" X 1 1/16")
S	F-9	20-LEAD FLAT PACK (1/4" X 1/2")
V	D-6	18-LEAD DUAL INLINE (1/4" X 15/16")
W	D-7	22-LEAD DUAL INLINE (3/8" X 1 1/8")
Y	D-10	28-LEAD DUAL INLINE (1/2" X 1 1/2")

LANSDALE
Semiconductor, Inc.
2929 S. 48th St., Suite #2
Tempe, AZ 85282
Phone: (602)438-0123
Fax: (602)438-0138

FOUNDRY SERVICE

Lansdale Semiconductor, Inc., offers flexibility in wafer processing. We manufacture 3 and 4-inch wafers to standard processes, designed from 6 to 36-volts (greater for custom products), utilizing 3-micron technology. The foundry is a complete bipolar and MOS wafer processing service for Digital, Linear, and Discrete devices. Our technologies include standard (non-gold doped) processing, gold-doped, Schottky (aluminum or TiW/PtSi), ion implanted resistors, 2-layer metal and Dielectric Isolated Circuits.

IC MANUFACTURING TECHNOLOGIES:

* Digital/Linear
* Full Custom
* Wafer Foundry Services
* Mil-Std-883C

SERVICES AVAILABLE:

* Parametrically tested wafers
* Die in Waffle Packs
* Packaged parts

TYPICAL PROCESS CHARACTERISTICS		RANGES		UNIT
		6-20 VOLT PROCESS	20-36 VOLT PROCESS	
Buried Layer	Rs. Xj.	14 5	14 5	Ohms/SQ Microns
Epi	Res. Thk.	0.15 - 3.0 4.5 - 10.0	1.0 - 5.0 9.0 - 16.0	Ohm-Cm Microns
Isolation	Rs.	6 - 12	6 - 12	Ohms/SQ
N+ Plug	Rs.	2 - 6	2 - 6	Ohms/SQ
Base	Rs. Xj.	100 - 400 0.7 - 2.5	100 - 400 1.5 - 3.5	Ohms/SQ Microns
Emitter	Rs.	2.5 - 9.0	2.5 - 9.0	Ohms/SQ
Cap. Oxide	Tox.	500 - 1500	500 - 1500	Angstroms
Metalization (Aluminum)	Thk.	1.1 - 2.0	1.1 - 2.0	Microns
Passivation (Vapox or PEO)	Tox.	1.0 - 2.0	1.0 - 2.0	Microns
LVceo		8 - 23	23 - 38	Volts
BVcbo		>30	>70	Volts
Beta (NPN)		>40	>60	—
Beta (Lateral PNP)		>10	10 - 45	—
Beta (Vertical PNP)		>20	50 - 100	—

Lansdale Semiconductor

Lansdale
Semiconductor, Inc.

2929 S. 48th St., Suite 2, Tempe, AZ 85282
Phone: (602) 438-0123 Fax: (602) 438-0138

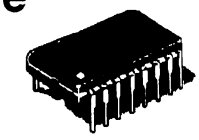
Lansdale manufactures older technology integrated circuits and has complete foundry facilities. Following is a summary of the current product line, showing the original manufacturer and product type.

ORIGINAL MANUFACTURER	PRODUCT	PART NUMBER
AMD	Bipolar Digital	2501, 2506, 2905, 2906, 2915
HARRIS	Bipolar PROM	0512
	Quad Power Strobe	6600
	Monolithic Diode	0168, 0186 0410, 0104, 0198
	Bipolar PROM	7600 Series
INTEL	Microprocessor	8080A
	Peripherals	8200 Series
	Octal	8282, 8283, 8286, 8287, 8289
MOTOROLA	SUHL/TTL	400/500 Series
	HTL	660T Series
	RTL	800/900 Series
	DTL	830/930 Series
	Linear	1500 Series/1710
	SUHL/TTL II	2000/2100 Series
	TTL III	3000/3100 Series
	TTL	4000/4300 Series
	SUHL/TTL	5000/5100 Series
	TTL	5400/7400 Series
	TTL III	54H00/74H00 Series
	TTL	7200/8200 Series
	TTL	8300/9300 Series
NATIONAL/FAIRCHILD	PMOS	3300 Series
	PMOS	3262, 2466, 3708, 3844, 3845
RAYTHEON	DTL	200 Series
SIGNETICS	DTL	100, 400, 700 Series
	UTiLOGIC II	300 Series
	DTL	600 Series
	TTL	5400/7400 Series
	TTL III	54H00/74H00 Series
	TTL - Interface	8T00 Series
	TTL	8200 Series
	TTL	8800 Series
	TTL - Interface	8H00 Series

•883C Compliant Products Available

•Complete Foundry Service

- Mask Provided
-Custom, Semi-custom



•Reverse Engineering and Emulation Available

•Dedicated to TQC

Lansdale Semiconductor

Lattice

GAL® Device Menu

High Speed E²CMOS® PLDs

Universal GAL Devices

FAMILY	PART #	Tpd (ns)	Fmax (MHz)	Icc Typ (mA)	Icc Max (mA)	DEDICATED INPUTS	I/O MACRO CELLS	PRODUCT TERMS/OUTPUT	PACKAGE
GAL16V8	GAL16V8B-7L	7.5	100	75	115	8	8	8	20-Pin P-DIP & 20-Lead PLCC
	GAL16V8B-10L	10	62.5	75	115				
	GAL16V8A-15Q	15	62.5	45	55				
	GAL16V8A-15L	15	62.5	75	115				
	GAL16V8A-25Q	25	41.6	45	55				
	GAL16V8A-25L	25	41.6	75	90				
GAL18V10	GAL18V10-15L	15	62.5	75	115	8	10	8 - 10	
	GAL18V10-20L	20	62.5	75	115				
GAL20V8	GAL20V8B-7L	7.5	100	75	115	12	8	8	24-Pin P-DIP & 28-Lead PLCC
	GAL20V8A-10L	10	62.5	75	115				
	GAL20V8A-15Q	15	62.5	45	55				
	GAL20V8A-15L	15	62.5	75	115				
	GAL20V8A-25Q	25	41.6	45	55				
	GAL20V8A-25L	25	41.6	75	90				
GAL20XV10	GAL20XV10B-10L	10	76.9	75	90	10	10	4	
	GAL20XV10B-15L	15	62.5	75	90				
GAL22V10	GAL22V10B-10L	10	105	90	130	12	10	8 - 16	
	GAL22V10-15L	15	62.5	90	130				
	GAL22V10-25L	25	38.5	90	130				
GAL26CV12	GAL26CV12-15L	15	62.5	90	130	14	12	8 - 12	28-Pin P-DIP & 28-Lead PLCC
	GAL26CV12-20L	20	62.5	90	130				

Asynchronous GAL Devices

FAMILY	PART #	Tpd (ns)	Fmax (MHz)	Icc Typ (mA)	Icc Max (mA)	DEDICATED INPUTS	I/O MACRO CELLS	PRODUCT TERMS/OUTPUT	CLOCKS	PACKAGE
GAL20RA10	GAL20RA10-12L	12	71.4	75	100	10	10	8	10	24-Pin P-DIP & 28-Lead PLCC
	GAL20RA10-15L	15	50	75	100					
	GAL20RA10-20L	20	41.7	75	100					
	GAL20RA10-30L	30	25	75	100					

FPLA GAL Devices

FAMILY	PART #	Tpd (ns)	Fmax (MHz)	Icc Typ (mA)	Icc Max (mA)	MACROCELLS				PROD TERMS	SUM TERMS	PACKAGE
						I/O	BURIED	INPUT	OUTPUT			
GAL6001	GAL6001-30	30	27	90	150	10	8	10	10	64	36	24-Pin P-DIP & 28-Lead PLCC
	GAL6001-35	35	22.9	90	150							

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January 1992

Applications & Literature Hotline: 1-800-FASTGAL or FAX (503) 681-3037

Lattice Semiconductor

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You get a complete turnkey solution for your custom IC needs. Your engineers are not tied up doing IC and test program design. We do all the work using State-of-the-Art CAE/CAD for circuit design, schematic capture, simulation, layout and verification of the custom IC and advanced ATE to 100% test each IC.

Extra Benefit #2
Your system integration is maximized because we take the trouble to completely understand your system. Using our system and circuit design expertise, we innovate solutions to include all the ANALOG and DIGITAL functions which can be integrated. (We can help with your system design too.)

Extra Benefit #3
Your circuit design and layout are optimized to reduce function area, interconnect and pin count. This minimizes unit price and maximizes performance and reliability.

Extra Benefit #4
You are offered the LSI process which is best suited for your application. We can do this because we purchase wafer fabrication from foundries with a broad range of process capabilities.

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Your production is multi-sourced at every step of the manufacturing process. Masks, wafer fabrication and assembly are each procured from several reliable sources, ensuring on-time production deliveries.

Extra Benefit #6
You have the ultimate in proprietary protection for your product design. Your competition sees what your product does, but with a proprietary Extra-custom IC working for you, they won't be able to easily decipher technique, or compete with your manufacturing cost.

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You receive quality service in every aspect of the custom circuit's development and production. We provide the support required to guarantee your product's success.

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Telephone (516) 271-0400 FAX (516) 271-0405

PROGRAMMABLE DIGITAL DELAY TIMER

LS7210 (14 Pin DIP)
Programmable Digital Delay Timer
- Generates delays from milliseconds to "infinity"
- Delays programmed by 5 Binary Weighted inputs and input frequency
- External clock or external RC at oscillator port sources input frequency
- Four selectable Operating Modes:
  DUAL DELAY DELAYED OPERATE
  ONE-SHOT DELAYED RELEASE
- 4.75V to 15V operation

DIVIDERS

RED SERIES (8 Pin DIP)
50Hz/60Hz CMOS Time Base Generators
- Frequency division of 50 Hz/60 Hz sine waves
- 50 Hz/60 Hz DIVISION SELECT input
- RESET and ENABLE input controls
- CLOCK input shaping network can interface directly with 50Hz/60Hz AC Line through an external current limiting resistor
- 4.5V to 15V operation
- Available Dividers:
  5/6, 50/60, 100/120, 300/360, 500/600, 3000/3600

RDD 104 (8 Pin DIP)
Selectable Four Decade CMOS Divider
- Divides by 10, 100, 1000 or 10,000
- DIVISION SELECT determined by state of two inputs
- RESET input
- External Clock or external Crystal across active oscillator network sources input frequency
- 4.5V to 15V operation

COUNTERS

LS7030 (40 Pin DIP)
Eight Decade Up Counter
- DC to 10 MHz Count Frequency
- Multiplexed BCD and 7 Segment data outputs
- Leading Zero Blanking output
- Decimal Point and Overflow control inputs
- On-chip Scan Oscillator
- 4.75V to 15V operation

LS7031 (40 Pin DIP)
Six Decade Up Counter with Eight Decade Latch
- DC to 10 MHz Count Frequency
- Multiplexed BCD data outputs
- Access to the two LSD latches allows attachment of external prescalers for counting to 1 GHz
- Leading Zero Blanking output
- Decimal Point and Overflow control inputs
- On-chip Scan Oscillator
- 4.75V to 15V operation

COUNTERS (cont'd)

LS7040 (40 Pin DIP)
Dual Three Decade Up/Down Counter
- DC to 350 KHz Count Frequency
- Fully Synchronous counting
- Cascadable
- Parallel BCD outputs
- Separate Reset and Enable control inputs for each three decade counter
- 4.75V to 15V operation

LS7055-LS7056 (40 Pin DIP)
Six Decade Pre-Determining Up/Down Counter
- DC to 250 KHz Count Frequency
- Fully Synchronous counting
- Multiplexed BCD and 7 Segment data outputs
- Preset, Presignal and Mainsignal Storage Registers
- Three Comparators with Output Flags
- Thumbwheel interface for loading registers
- On-chip Scan Oscillator
- 4.75V to 15V operation

LS7060/LS7062 (18 Pin DIP)
32-Bit/Dual 16-Bit Binary Up Counter
- DC to 15 MHz Count Frequency
- Byte multiplexed Three-State data outputs
- Unique Cascade Feature allows data bytes from many counters to be sequentially multiplexed to the output bus in a Multiple Counter System
- 32-bit latch
- 4.75V to 5.25V operation

LS7061/LS7063 (24 Pin DIP)
32-Bit/Dual 16-Bit Binary Up Counter
- Same features as LS7060/LS7062 except there is a 40-bit latch instead of 32-bit latch
- Ability to latch external eight bits allows attachment of external prescaler for counting to 3.84 GHz

LS7166 (20 Pin DIP)
24-Bit Multi-Mode Counter
- DC to 20 MHz Count Frequency
- 8-bit I/O bus for Microprocessor communication and control
- Programmable modes are: Up/Down, Binary, BCD, 24 Hour Clock, Divide-by-N, Single Cycle, and X1, X2 and X4 Quadrature
- 24-bit comparator for preset count comparison
- TTL and CMOS compatible
- 4.5V to 5.5V operation

QUADRATURE PULSE DECODERS

LS7082 (14 Pin DIP)
Quadrature Clock Converter
- Interface for Optical or Magnetic Encoder signals to standard UP/DOWN Counters
- On-chip filtering of Quadrature Clocks
- X1, X2 and X4 mode selection
- Up to 16 MHz Output Clock Frequency
- Adjustable output clock pulse width
- UP/DOWN count control output
- INDEX input and output
- TTL and CMOS compatible

LS7083/LS7084 (8 Pin DIP)
Quadrature Clock Converters
- Same features as LS7082 except no X2 mode and no INDEX input and output
- LS7083 Outputs: UP CLOCK and DOWN CLOCK
- LS7084 Outputs: CLOCK and UP/DOWN count control

LIGHTING CONTROLS

LS7231-LS7234 (8 Pin DIP)
Touch Control Continuous Dimmer Light Switch
- Touch or mechanical switch SENSE input control
- Momentary SENSE input activation causes ON/OFF switching
- Prolonged SENSE input activation causes variable dimming operation
- Brightness Memory and Dimming Direction Reverse features depending on Part Number
- DOZE input for external control of DIM-TO-OFF time
- SLAVE input for control by Remote Extension

LS7237 (8 Pin DIP)
Touch Control Step Dimmer Light Switch
- Touch or mechanical switch SENSE input control
- MODE input selects 1, 3, or 4 level Brightness Sequence
- SLAVE input for control by Remote Extension

LS7331(14 Pin DIP)
Touch Control Continuous Dimmer Light Switch with Interface Signals for Microprocessor Control
- Same features as the LS7231
- Light Status outputs allow for Microprocessor control

LS7338 (8 Pin DIP)
Touch Control Light Switch with Timed-ON and Delayed-OFF Modes
- Touch or mechanical switch SENSE input control
- Operating Sequence: TIMED-ON —> DELAYED-OFF —> OFF
- Manual or Automatic Sequence Advance
- External RC controls Timed-On period
- Transition from Timed-On mode to Delayed-Off mode indicated by reduction of light brightness
- Light DIMS-TO-OFF during the programmed Delayed-Off period

LS7339-LS7040 (8 Pin DIP)
Touch Control ON-OFF Light Switch with Retriggerable Timed-ON Mode.
- Touch or mechanical switch ON and OFF input controls
- External RC controls Timed-On period
- On period timer retriggers with each activation of ON input

LIGHTING CONTROLS (cont'd)

LS7314-LS7315 (16 Pin DIP)
Touch Control Multi-Level Light Switch
- Touch or mechanical switch input controls
- Up to ten selectable BRIGHTNESS LEVEL inputs
- A selected BRIGHTNESS LEVEL input becomes an output which can drive an LED to indicate the selected Brightness

LS7534-LS7535 (8 Pin DIP)
Touch Control Dimmer Light Switch with Up and Down Controls
- Touch or mechanical switch UP and DOWN input controls
- Momentary UP/DOWN input activation cause ramping to MEMORY ON/OFF states
- Prolonged UP/DOWN input activation cause variable dimming operation towards MAX/MIN Brightness Levels
- DOZE input for external control of DIM-TO-OFF time

BRUSHLESS DC MOTOR CONTROLS

LS7260-LS7262 (20 Pin DIP)
Brushless DC Motor Commutator/Controller
- Open or closed loop control of 3 and 4 phase motors
- HALL SENSOR inputs control output commutation sequence for electrical sensor spacings of 60°, 120°, 240°, or 300°
- Speed controlled by Pulse Width Modulation of output drivers
- Control inputs include ANALOG SPEED, FORWARD/REVERSE, OUTPUT ENABLE and POSITIVE STATIC BRAKING
- OVERCURRENT SENSING disables output drivers
- Direct drive of FETs (LS7260) and Bipolar Transistors (LS7261/ LS7262)
- Controls Brush DC Motors in "H-Bridge" configuration
- 5V to 28V operation

LS7362 (20 Pin DIP)
Brushless DC Motor Commutator/Controller
- Same features as LS7262 except Pulse Width Modulation occurs only in low-side drivers allowing use with High-Voltage motors

LS7263 (18 Pin DIP)
Three Phase Brushless DC Motor Speed Controller
- Regulates speed to +/- 0.1% accuracy for 3600 RPM applications
- 3.58 MHz crystal time base
- Other speeds accommodated with modified ROM and crystal frequency
- Rapid acceleration to speed
- Positive Static Braking
- Overcurrent Sensing
- Low Speed Detection output
- Direct drive of Bipolar Transistors
- 10V to 28V operation

LS7264 (16 Pin DIP)
Four Phase Brushless DC Motor Speed Controller
- Same features as LS7263 except as shown below
- 2.4576 MHz crystal time base
- Forward/Reverse control input

AC MOTOR CONTROLS

LS7237(8 Pin DIP)
AC Motor Sequential Step Speed Controller
- Controls speed of small AC motors
- Touch or mechanical switch input control
- MODE input selects 1, 3, or 4 step speed sequence

LS7310-LS7313(18 Pin DIP)
Multi-Level AC Motor Speed Controllers
- Touch or mechanical switch input controls
- Up to ten selectable SPEED LEVEL inputs
- A selected SPEED LEVEL input becomes an output which can drive an LED to indicate the selected speed
- ON, OFF and PULSE control inputs

LS7314-LS7315 (16 Pin DIP)
Multi-Level AC Motor Speed Controller
- Same features as LS7310-LS7313 except there are no ON and PULSE control inputs

LS7339-LS7340 (8 Pin DIP)
On-Off AC Motor Control with Retriggerable Timed-On Mode
- Touch or mechanical switch input controls
- External RC controls Timed-On period
- On period timer retriggers with each application of ON input
- Applications include Auto Shut-Off appliance timers

DYNAMIC SCATTERING LIQUID CRYSTAL DISPLAY DRIVERS

LS7100 (16 Pin DIP)
BCD TO 7 Segment Latch/Decoder/Driver
- Drives Dynamic Scattering Liquid Crystal Displays
- Up to 50V drive per segment output
- 5V to 60V operation
- BLANKING and LOAD input controls
- Inputs are TTL and CMOS compatible

LS7110 (16 Pin DIP)
Binary Addressable Latched Eight Channel Demultiplexer/Driver
- Drives Dynamic Scattering Liquid Crystal Displays
- Up to 50V drive per output
- 5V to 60V operation
- ADDRESS and LOAD input controls
- Inputs are TTL and CMOS compatible

MASK PROGRAMMABLE MELODY GENERATORS

LS3404-XX (8 Pin DIP)
High Quality Melody Circuits
- Produces chime quality musical sound
- 255 note capacity Mask-Programmable ROM
- Excellent pitch resolution
- Exponential decay imposed on each note
- Direct drive of Piezo Transducer
- Single transistor interface for standard speaker
- 4.5V to 15V operation
- Thirty-one programmed melodies available

PROGRAMMABLE DIGITAL LOCKS

LS7220 (14 Pin DIP)
Automotive Ignition Digital Lock Circuit
- 5,040 four digit Combinations (for a 10 number keypad)
- Combinations are hard-wire programmed
- SENSE input enables chip operation
- Save Memory feature saves Unlock Condition for Valet Parking
- SAVE input sets Save Memory and LOCK input resets SAVE Memory
- Save Memory and Lock Status outputs
- Convenience Delay determined by external capacitor
- Static or Momentary Lock Control output

LS7222-LS7223 (20 Pin DIP)
Keypad Programmable Digital Lock Circuit
- 38,416 four digit Combinations (for a 4 x 4 keypad matrix)
- 3 different user programmable codes
- LS7222 Programmable Codes: Arm, Disarm, Duress
- LS7223 Programmable Codes: Lock 1, Lock 2, Duress
- Lock and Program Status Outputs
- Static and Momentary Lock Control outputs
- Alarm and Tamper Detection outputs

LS7225-LS7226 (14 Pin DIP)
Machine or Area Access Digital Lock Circuit
- 5,040 four digit Combinations (for a 10 number keypad)
- Combinations are hard-wire programmed
- SEQUENCE ENABLE input enables Combination Entry
- Combination Entry time controlled by external capacitor
- Static and Momentary Lock Control outputs
- Tamper Detection output
- Lock Status output

LS7228-LS7229 (16 Pin DIP)
Serial Address Decoder/ 2 Pushbutton Digital Lock Circuit
- 512 nine bit Combinations
- Combinations are hard-wire programmed
- LS7228: Dual pulse train input combination entry
- LS7229: Two pushbutton input combination entry
- Static or Momentary Lock Control output
- Code bit-entry time controlled by external capacitor

TELEPHONE LINE CONTROLS

LS75XX (16 Pin DIP)
Tone Activated Telephone Line Switch Controllers
- Circuit activated by Tone with specific Frequency and Time Duration
- Frequency and Time Duration values are mask programmable
- Small Signal (as low as - 30 DBM) and Digital Level Tone signals accommodated.
- On-chip active oscillator network and 32,768 Hz Crystal generates timing.
- Low power consumption
- 2.5V to 6V operation.
- Ten programmed frequencies available.
- Applications include Remote Telephone Line Testing, Remote Meter Reading, and Security System Auto-Dialers

LSI LOGIC

Products and Services

Introduction

ASICs

LSI Logic is the leading designer, developer and manufacturer of the most advanced ASICs (Application-Specific Integrated Circuits) in the industry. The company's broad ASIC line includes high-performance HCMOS Array-Based and Cell-Based ASICs which integrate random logic, microprocessors and memory on chips with up to 200,000 equivalent gates. LSI Logic also manufactures and markets SPARC and MIPS microprocessors using Reduced Instruction Set Computing (RISC) technology and other selected standard products.

Military

Radiation-hardened versions of Array-Based ASICs are available from 10,000 to 70,000 usable gates with a total dose of 200 to 1,000 Krads (Si). LSI's mil/aero facility in Fremont, CA is fully self-contained, with assembly, burn-in, test and qualification in one domestic location.

ASIC Design Tools

LSI Logic's ASIC Design Tools include C-MDE™ (Concurrent Modular Design Environment) Design System, Silicon 1076 (VHDL) and Third Party interfaces, which support silicon-specific methodology and are fully integrated with LSI's advanced manufacturing capabilities.

The C-MDE Design System is a new state-of-the-art ASIC design environment that enables you to meet or beat your time to market deadlines. The C-MDE Design System combines new capability, ease of use and LSI Logic's proven ASIC design methodology with powerful results.

The C-MDE Design System combines advanced ASIC design capability, productivity and concurrent design, our direct link to manufacturing and our proven tool set with a record of over 10,000 successful designs to guarantee Right-First-Time ™ silicon. This design methodology contains powerful LSI Logic applications for each step and complexity of ASIC design .

Silicon 1076 is the next generation ASIC development environment that provides a complete concept-to-silicon design methodology based on VHDL (VHSIC Hardware Language) and synthesis.

RISC Microprocessors

The LSI Logic MIPS and SPARC microprocessor product lines provide open-architecture RISC design solutions. A variety of peripheral chips and chipsets, including processors optimized for embedded control and innovative chip-on-board module packaging technology, enhance the product line. LSI Logic's leading-edge microprocessor products simplify design and shorten the time-to-market for SPARC- and MIPS-based products.

DSP Products

LSI Logic's Digital Signal Processing (DSP) family currently includes 32-bit building block processors, special purpose memory devices, function-specific DSP, Crossbar Switch, Error Correcting Reed-Solomon Codec, and Still Image and Video Compression Chipsets.

When the performance required far exceeds that which can be delivered by a single chip DSP microprocessor, system designers can turn to "function-specific DSP" devices, which are optimized to perform a particular algorithm or function. LSI Logic offers devices capable of processing video data at 20 or even 40 MHz in real time. Applications include image processing, radar, sonar, C31, visualization systems and any application where video data rates are required.

Image and video compression products, the newest LSI Logic DSP products, offer the ability to drastically reduce the amount of digital information required to store or transmit images–with still or full motion video. The Still Image Compression Chipset is compatible with the JPEG standard while the Video Compression Chipset is designed to the CCITT H.261 standard.

LSI LOGIC

Products and Services

MIPS Microprocessor Components

Device Type	Product Code	Description	Clock (MHz)	Package	Available
LR2000 Family	LR2000	MIPS RISC CPU	12.5, 16.7	144 CPGA	Now
	LR2010	Floating-Point Accelerator	12.5, 16.7	84 CLDCC-J	Now
	LR2020	Write Buffer	12.5, 16.7	68 PLCC	Now
LR3000 Family	LR3000	MIPS RISC CPU	16.7, 20, 25	172 CLDCC	Now
				144 CPGA	Now
	LR3000A	Enhanced MIPS RISC CPU	25, 33.3, 40	175 CPGA[1]	Now
				172 CLDCC[1]	Now
			20, 25, 33.3	160 MQFP[1]	Now
				172 CLDCC[1]	Now
	LR3010	Floating-Point Accelerator	16.7, 20, 25	84 CPGA[1]	Now
				84 CLDCC[1]	Now
	LR3010A	Enhanced Floating-Point Accelerator	25, 33.3, 40	84 CPGA[1]	Now
				84 CLDCC[1]	Now
			20, 25, 33.3	160 MQFP	Now
	LR3020	Write Buffer	16.7, 25	68 PLCC	Now
	LR3220	Integrated Read-Write Buffer	25, 33.3	180 CPGA	Now
	LR3230	Enhanced Read-Write Buffer	33.3, 40	223 CPGA[1]	Now
LR4000 Family	LR4000 SC	64-bit Integrated CPU/FRA and Cache	50	447CPGA	Q1'92
	LR4000 MC			447CPGA	Q1'92
	LR4000 PC			179 CPGA	Q4'91
MipSET™	LR3201	RST/INT Controller	25	64 PQFP	Now
				CPGA	
	LR3202A	L-Bus Controller	25	208 PQFP	Now
				224 CPGA	
	LR3203	DRAM Controller	25	160 PQFP	Now
				180 CPGA	
	LR32D04	Dual DRAM Data Buffer	25	100 PQFP	Now
				100 CPGA	
	LR3205	Block Transfer Buffer	25	208 PQFP	Now
				224 CPGA	
	LR3208	Video Frame Controller	25	120 PQFP	Now
				CPGA	
MIPS Ngine™	RPM3310	LR3000 and LR3010 Module with 32K Instruction and Data Cache and Read-Write Buffer	20, 25	Module Board	Now
	RPM3330	LR3000A and LR3010A Module with 64K Instruction and Data Cache, Read-Write Buffer, and Multiprocessor Support	33.3, 40	Module Board	Now
Embedded Processor	LR33000	Highly Integrated MIPS-based Embedded Processor	25, 33.3, 40	155 CPGA[1]	Now
			25, 33.3, 40	160 MQFP[1]	Now
Pocket Rocket	BD-999-MPR25	LR33000 Evaluation Board	25	Printed Circuit Board	Now

Notes:
1. Cavity-down.

Documentation

Title	Order Number
LR3000 and LR3000A MIPS RISC Microprocessor User's Manual	J14000.A
LR3010 and LR3010A User's Manual (Revision A)	J14005
MipSET Technical Manual (Revision A)	J14003
LR33000 MIPS Embedded Processor User's Manual	J14001
RPM3310 MIPS Ngine Module Technical Manual	J14002
LR3230 Enhanced Read-Write Buffer Datasheet	J14006

MIPS Microprocessor Training

Product	Product Code	Description	Registration
LR3000 Hardware System Design Course	TR-R99-M0001	This in-depth, two-day introductory course greatly improves a designer's productivity by presenting the important MIPS LR3000 system design issues. Topics covered include cache design, multi-processor applications, board layout considerations, and interfacing to EPROMs, SRAMs peripheral devices, write buffers, and a floating-point accelerator.	Classes are held at LSI Logic facilities in Milpitas, CA, and at customer sites. Contact LSI Logic, MIPS Marketing (phone 408-954-4625 or FAX 408-433-7447) for schedules and pricing.
LR3000 Software System Design Course	TR-R99-M0002	This three-day course presents the software design issues related to the MIPS LR3000. Topics covered include assembly language and C programming, using the System Programmer's Package (SPP) for program development, using cache and subroutine mechanisms, writing interrupt handlers and PROM and DBGMON monitors, executing on target hardware, and performance-tuning tools. Hands-on lab exercises make this course an invaluable tool for all LR3000 software developers.	Classes are held at LSI Logic facilities in Milpitas, CA, and at customer sites. Contact LSI Logic, MIPS Marketing (phone 408-954-4625 or FAX 408-433-7447) for schedules and pricing.

Ordering Information

LR3000 L C -16

- **-16** — Operating Frequency
  - 16 = 16 or 16.7 MHz
  - 20 = 20 MHz
  - 25 = 25 MHz
  - 33 = 33.3 MHz
  - 40 = 40 MHz
- **C** — Temperature Range
  - C = Commercial
  - M = Military
- **L** — Package Code
  - C = CPGA
  - L = CLDCC
  - J = PLCC
  - K = CLDCC (cavity-down)
  - H = CPGA (cavity-down)
  - Q = PQFP
- **LR3000** — Product Code

Applications Support

1-800-232-MIPS; 8:00 am to 5:00 pm PST.

SPARC Microprocessor Components

SS2 Family	Description	Product Code	Clock Rate (MHz)	Packages	Available	Alternate Source
SparKIT-20	Integer Unit	L64801QC	20	160 PQFP	Now	
		L64801NC	20	179 PPGA	Now	
	Floating-Point Unit	L64804GC	20	143 CPGA	Now	W3172
	Memory Management Unit	L64821QC	20	120 PQFP	Now	
	Data Buffer	L64822QC	20	120 PQFP	Now	
	Clock Controller	L64823JC	20	44 PLCC	Now	
	Cache Controller	L64824QC	20	160 PQFP	Now	
	SBus DRAM Controller	L64826QC	20	100 PQFP	Now	
	SBus DMA Controller	L64853QC	20	120 PQFP	Now	
SparKIT-20+	Integer Unit	L64801QC	25	160 PQFP	Now	
		L64801NC	25	179 PPGA	Now	
	Floating-Point Unit	L64804GC	25	143 CPGA	Now	W3172
	Memory Management Unit	L64821QC	25	120 PQFP	Now	
	Data Buffer	L64827QC	25	120 PQFP	Now	
	Clock Controller	L64823JC	25	44 PLCC	Now	
	Cache Controller	L64828QC	25	160 PQFP	Now	
	SBus DRAM Controller	L64829QC	25	100 PQFP	Now	
	SBus DMA Controller	L64853QC	25	120 PQFP	Now	
SparKIT 40	Enhanced IU	L64811GC	40	207 CPGA	Now	CY7C601
	Enhanced FPU	L64814GC	40	207 CPGA	Now	W3171
	Enhanced MMU	L64841QC	40	160 PQFP	Now	
	Enhanced Cache Controller	L64844GC	40	224 CPGA	Now	
	Enhanced DRAM Controller	L64846QC	40	160 PQFP	Now	
	Enhanced DMA Controller	L64853AQC	20	120 PQFP	Now	
Mbus Family						
SparKIT-25	Enhanced Integer Unit	L64811GC	25	207 CPGA	Now	CY7C601
	Enhanced Floating-Point Unit	L64814GC	25	143 CPGA	Now	W3171
	Memory Management, Cache Controller, Cache Tag (MCT) Unit	L64815GC	25	223 CPGA	Q4'91	CY7C604
	Mbus DRAM Controller	L64850GC	25	223 CPGA	Now	
	Mbus-to-STDIO Interface	L64851QC	25	208 PQFP	Now	
	Mbus-to-SBus Interface	L64852GC	25	223 CPGA	Q4'91	
	SBus Interface and DMA Controller	L64853QC	25	120 PQFP	Now	
	SBus DMA+Controller	L64853AQC	25	120 PQFP	Now	
SparKIT-33	Enhanced Integer Unit	L64811GC	33	207 CPGA	Now	CY7C601
	Enhanced Floating-Point Unit	L64814GC	33	143 CPGA	Now	W3171
	Memory Management, Cache Controller, Cache Tag (MCT) Unit	L64815GC	33	223 CPGA	Q4'91	CY7C604
	Mbus DRAM Controller	L64850GC	33	223 CPGA	Now	
	Mbus-to-STDIO Interface	L64851QC	33	208 PQFP	Now	
	Mbus-to-SBus DMA+Interface	L64852GC	33	223 CPGA	Q4'91	
SparKIT-40	Enhanced Integer Unit	L64811GC	40	207 CPGA	Now	CY7C601
	Enhanced Floating-Point Unit	L64814GC	40	143 CPGA	Now	W3171
	Memory Management, Cache Controller, Cache Tag (MCT) Unit	L64815GC	40	223 CPGA	Q4'91	CY7C604
	Mbus DRAM Controller	L64850GC	40	223 CPGA	Now	
	Mbus-to-STDIO Interface	L64851QC	40	208 PQFP	Now	
	Mbus-to-SBus DMA+Interface	L64852QC	40	223 CPGA	Q4'91	
Graphics Family						
	SBus Video Frame Buffer	L64825QC	20/25	120 PQFP	Now	
	SBus Graphics Controller	L64855QC	20/25	160 PQFP	Now	
	SBus Graphics Accelerator (GX)	L64845GC	20/25	223 CPGA	Now	

Digital Signal Processing (DSP) Fixed-Point Multipliers

Device Type	Part Number	Description	Speed (ns) Commercial	Speed (ns) Military	Packages	Available
32-Bit MACs	L64032	32-Bit MAC with 64-Bit Mode	125	160	132 CPGA	Now
			100	125	132 CLDCC	Now
			80	100		Now

Floating-Point Processors

Device Type	Part Number	Description	Cycle Time (ns) Commercial	Cycle Time (ns) Military	Packages	Available
32-Bit Floating Point Processor	L64134	IEEE Multiplier and ALU	80	125	144 CPGA	Now
			60	100		Now
			50	80		Now

Signal and Image Processing Devices

Device Type	Part Number	Description	Clock Rate (MHz) Commercial	Clock Rate (MHz) Military	Packages	Available
Variable-Length Video Shift Register (VSR)	L64210	1K x 4 x 8 Line Delay	15	12	68 PLCC	Now
			20	16	68 CPGA	Now
	L64211	512 x 8 x 8 Line Delay	15	12	120 CPGA	Now
			20	16	120 PPGA	Now
High Speed Variable-Length Video Shift Register (HVSR)	L64212	1K x 4 x 8 Line Delay	30	20	95 CPGA	Now
			40	30		Now
Rank-Value Filter (RVF)	L64220	12-Bit, 64-Tap Rank-Value Filter	15	12	155 CPGA	Now
			20	16		Now
Binary Filter and Template Matcher (BFIR)	L64230	1024-Tap Binary Data FIR Filter	15	12	155 CPGA	Now
			20	16		Now
8 x 8 Multi-Bit Filter (MFIR)	L64240	64-Tap, 8-Bit Data or 32-Tap, 16-Bit Data FIR Filter	15	12	155 CPGA	Now
			20	16		Now
3 x 3 Multi-Bit Filter (MFIR)	L64243	9-Tap, 8-Bit Data FIR Filter	20	20	68 CPGA	Now
			30	30	68 PLCC	Now
			40	40		Now
Versatile Fir Filter (VFIR)	L64245	26-Tap, 10-Bit Data at 40 MHz or 208-Tap, 10-Bit Data at 5 MHz	20	25	68 CPGA	Now
			30	30	68 PPGA	Now
			40	–		Now
Histogram/Hough Transform Processor (HHP)	L64250	4096 x 4096 Pixel Histogram and Hough Transform Processor	15	12	68 CPGA	Now
			20	16	68 PLCC	Now
Versatile FIR Filter Processor (VFIR)	L64260	Multi-Tap 16-Bit FIR Filter Processor	30	25	223 CPGA	Now
			40	30		Now
	L64261	Multi-Tap 16-Bit FIR Filter Processor	30	25	144 CPGA	Now
			40	30		Now
Crossbar Switch (XBAR)	L64270	64 to 64 Crossbar Switch with Pipeline and Flow-Through Modes	30	N/A	160 PQFP	Now
			40	N/A	180 PPGA	Now
Complex FFT Processor (FFTP)	L64280	Floating-Point Complex FFT Processor. Single and Multi-Processor Modes	30	25	144 CPGA	Now
			40	30		Now
FFT Video Shift Register (FFTSR)	L64281	FFT Video Shift Register Formats Data for L64280	30	30	132 CPGA	Now
			40	40		Now
Object Contour Tracer (TRACER)	L64290	Contour Tracer for Binary Images 128 x 128 with Internal RAM 1024 x 1024 with External RAM	15	12	68 CPGA	Now
			20	16		Now
R-S CODEC	L64710	8-Error Correcting Reed-Solomon Codec	40	30	68 CPGA	Now
			30	25		Now

LSI LOGIC

Products and Services

Digital Signal Processing (DSP) Compression Devices

Device Type	Part Number	Description	Speed	Packages	Available
JPEG	L64735	Discrete Cosine Transform Power	20	68 CPGA	Now
			27		
			35	100 PQFP	Now
	L64745	JPEG Coder	20	84 PGA	Now
			27	100 PQFP	Now
CCITT	L64715	Two-Error Correcting BCH Encoder-Decoder	30	44 PLCC	Now
			40		
	L64720	Video Motion Processor	30	68 CPGA	Now
	L64730	Discrete Cosine Transform Processor	40	68 PPGA	Now
	L64740	DCT Quantization Processor	30	84 CPGA	Now
	L64750	CCITT Variable Length Coder	20	68 CPGA	Now
			27	80 PQFP	Now
	L64751	CCITT Variable Length Decoder	20	68 PGA	Now
			27	100 PQFP	Now
	L64760	Inter-Frame Processor	30	100 PGA	Now
			40	100 PQFP	Now

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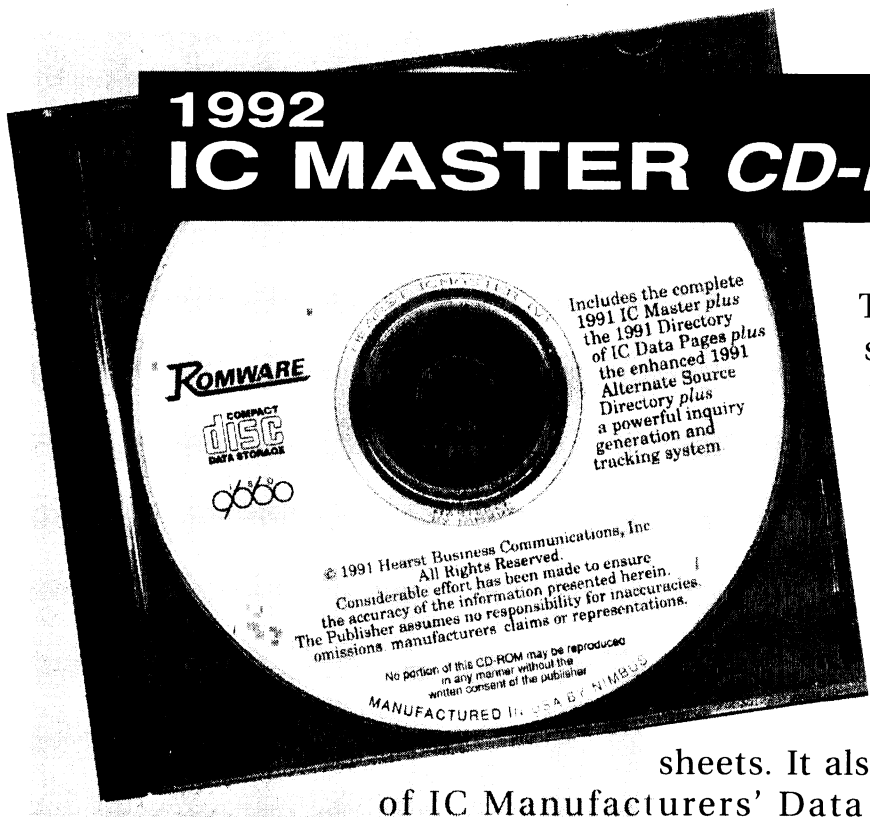
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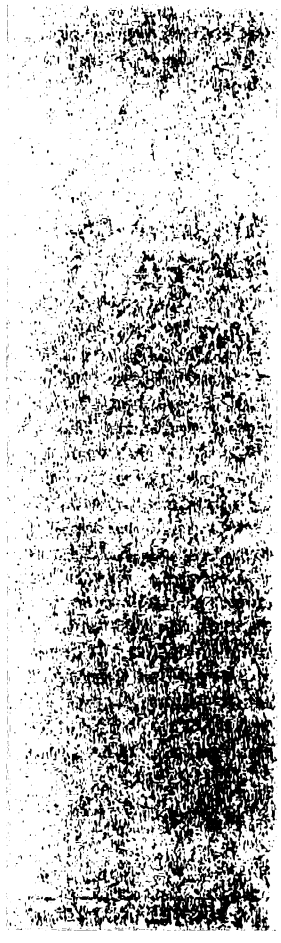
- SPICE Parameters available on Floppy disk

TESTING SERVICES

- Wafer Probe--Ambient to 125°C
- Final Test and Screening--Ambient, plus Hot/Cold Mil-STD 883
- Dice, Wafers, and Packaged Products



MICREL
SEMICONDUCTOR
THE INTELLIGENT POWER COMPANY™

Micrel Power MOSFET Drivers

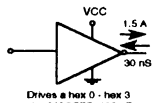
Micrel Features the industry's broadest line of Power MOSFET drivers.

From the blinding fast MIC4420 family of low side drivers to the full featured MIC5010 family of high and low side drivers, Micrel can truly claim "*One family drives all FETs*"

Why use N-Channel Power MOSFETs?

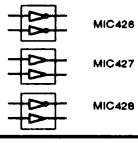
Price! That's why! Compared to P-Channel devices, the N-Channel MOSFET costs far less-- one-third to one-half of the PMOS price. What do you get for that 2.5X surcharge? Some say ease of high-side driving. But with the Micrel MIC5010 family, this argument no longer holds true. The low cost MIC5011 provides high performance high-side or low-side switching with low power dissipation and extremely low (CMOS compatible) drive requirements. The MIC5013 provides a current sense function that automatically disables the FET when an overcurrent situation occurs. All this ease-of-design and expanded functionality is inherent with a N-Channel power MOSFET paired with a MIC501x, and at a cost less than just the PMOS pass device.

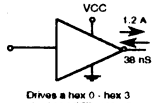
Low Side



MIC426 Family (Original)

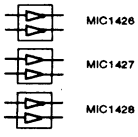
- 30 nS into 1000 pF
- 4.5 V to 18 V supply
- 1.5 A peak output
- 6 Ω output impedance
- Available in surface mount packages

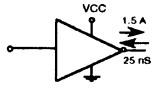




MIC1426 Family (Low Cost)

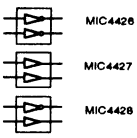
- Low cost predriver
- 38 nS into 1000 pF
- 4.75 V to 16 V supply
- 1.2 A peak output
- 8 Ω output impedance
- Available in surface mount packages

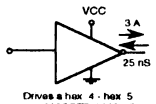




MIC4426 Family (Protected)

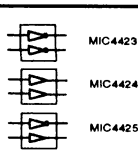
- Latch-up protected
- 25 nS into 1000 pF
- 1.5 A peak output
- Withstands 5 V negative swing
- 4.5 V to 18 V supply
- 7 Ω output impedance
- Available in surface mount packages

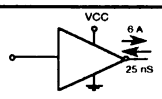




MIC4423 Family (High Current)

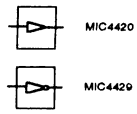
- Latch-up protected
- 25 nS into 1800 pF
- 3 A peak output
- Withstands 5 V negative swing
- 4.5 V to 18 V supply
- 3.5Ω output impedance
- Available in surface mount packages

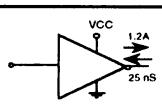




MIC4420/4429 (Singles)

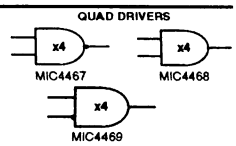
- Latch-up protected
- 25 nS into 10,000 pF
- 6 A peak output
- Withstands 5 V negative swing
- 4.5 V to 18 V supply
- 2.5 Ω output impedance
- Available in surface mount and high temperature packages



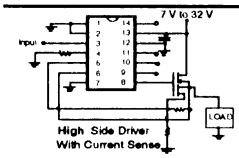


MIC4467 Family (Quads)

- Latch-up protected
- 25 nS into 470 pF
- 1.2 A peak output
- 4.5 V to 18 V supply
- Available in surface mount packages
- Three logic choices

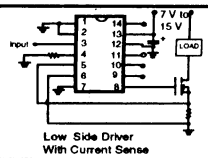


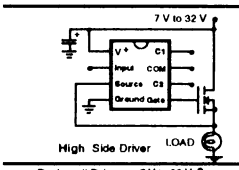
High or Low Side



MIC5010

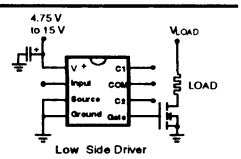
- Full featured predriver
- Optional speed up caps
- 7 V to 32 V supply
- Internal charge pump
- 60 µS into 1 nF
- Over current sensing
- Fault flag output
- Dynamic sensing threshold
- Surface mount packages

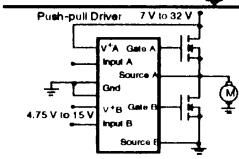




MIC5011

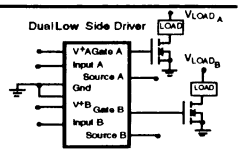
- Minimum parts count
- Optional speed up caps
- 4.75 V to 32 V supply
- Internal charge pump
- 60 µS into 1 nF
- Surface mount packages

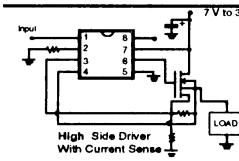




MIC5012

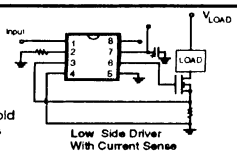
- Dual predriver
- Provides high and low side drive for H-bridge
- 4.75 V to 32 V supply
- Internal charge pump
- 60 µS into 1nF
- Surface mount packages





MIC5013

- Over current sensing
- 7 V to 32 V supply
- Internal charge pump
- 60 µS into 1 nF
- Fault flag output
- Dynamic sensing threshold
- Surface mount packages



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MICREL SEMICONDUCTOR
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Display Driver Selection Guide

If your product's display is:

Consider:

MIC7233 *MIC8013*
MIC8010 *MIC8014*
MIC8011 *MIC8030*
MIC8012 *MIC8031*

MIC4350 *MIC50396*
MIC4807 *MIC50397*
MIC5002 *MIC50398*
MIC5005 *MIC50399*
MIC5007 *MM5450*
MIC50395 *MM5451*

Vacuum Fluorescent

MIC4807 *MIC8014*
MIC8010 *MIC8030*
MIC8012 *MIC8031*
MIC8013

NUMERICAL	ALPHANUMERIC	DOT MATRIX
MIC4350	MIC7233	MIC8010
MIC4807	MIC8010	MIC8011
MIC5002	MIC8011	MIC8012
MIC5005	MIC8012	MIC8013
MIC5007	MIC8013	MIC8014
MIC50395	MIC8014	MIC8030
MIC50396	MIC8030	MIC8031
MIC50397	MIC8031	MM5450
MIC50398	MM5450	MM5451
MIC50399	MM5451	

DEVICE	Number of Segments	Serial Input/Latched Output	Counter	7 Segment Decoder	BCD Output	LED Driver	LCD Driver	Vacuum Fluorescent Driver	Single Supply	Single or Multiple Supplies	*PACKAGE*
MIC4350 Counter/Latch Decoder & Driver	7	•	•	•		•			•	•	16 Pin PDIP or 16 Pin CerDIP
MIC4807 Protected Addressable Low Side Driver	8					•		•	•	•	18 Pin PDIP or 18 Pin CerDIP
MIC5002 Four Digit Counter Decoder	4x7	•	•	•	•	•			•	•	28 Pin DIP
MIC5005 Four Digit Counter Decoder	4x7	•	•	•		•			•	•	24 Pin PDIP
MIC5007 Four Digit Counter Decoder	4x4	•	•		•	•			•	•	16 Pin PDIP
MIC50395 Six Decade Counter Decoder to 9999.99	6x7	•	•	•	•	•			•		40 Pin PDIP
MIC50396 Six Decade Counter Decoder to 99:59:59	6x7	•	•	•	•	•			•		40 Pin PDIP
MIC50397 Six Decade Counter Decoder to 59:59.99	6x7	•	•	•	•	•			•		40 Pin PDIP
MIC50398 Six Decade Counter Decoder	6x7		•	•		•			•		28 Pin PDIP
MIC50399 Six Decade Counter Decoder	6x7		•		•	•			•		28 Pin PDIP
MIC7233 Alphanumeric LCD Driver	4x18	•					•		•		40 Pin PDIP
MIC8010 Dichroic LCD Driver	30	•					•	•	•	•	40 Pin PDIP or 40 Pin LCC
MIC8011 Dichroic LCD Driver	38	•					•	•	•	•	48 Pin PDIP or 52 Pin QFP
MIC8012 Dichroic LCD Driver With Switching Regulator	30	•					•	•	•	•	40 Pin PDIP
MIC8013 Dichroic LCD Driver	30	•					•	•	•	•	40 Pin DIP/LCC
MIC8014 Dichroic LCD Driver	32	•					•	•	•	•	44 Pin PLCC or 44 Pin Cer Quad
MIC8030 50V LCD Driver	32	•					•	•		•	44 Pin Cer Quad
	38	•					•	•		•	48 Pin PDIP
MIC8031 100V LCD Driver	32	•					•	•		•	44 Pin Cer Quad
	38	•					•	•		•	48 Pin PDIP
MM5450 LED Display Driver	34	•				•			•		40 Pin PDIP or 44 Pin PLCC
MM5451 LED Display Driver	35	•				•			•		40 Pin PDIP or 44 Pin PLCC

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MICREL SEMICONDUCTOR
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Latched Driver Selection Guide

All Micrel Latched Drivers are available in die form. Special package options available on most latched drivers: please contact factory for details.

Latched Driver	Maximum Voltage	I_{OUT}	Transient Protection	Temp Range	Package
MIC4807 Protected Addressable Low Side Driver	80V	200mA	Diode	A,B	CerDIP, PDIP
MIC5800 4 Bit Parallel Input	50V	500mA	Diode	A,B	CerDIP, PDIP, SOIC
MIC5801 8-Bit Parallel Input	50V	500mA	Diode	A,B,C	CerDIP, PDIP, SIP
MIC58P01 8-Bit Parallel, Protected	70V	500mA	Diode	A,B	CerDIP, PDIP
MIC59P50 8-Bit Parallel, Protected	70V	500mA	Diode	A,B	CerDIP, PDIP
MIC5821 8-Bit Serial Input	50V	500mA	—	A,B,C	CerDIP, PDIP
MIC5822 8-Bit Serial Input	80V	500mA	—	A,B	CerDIP, PDIP
MIC5841 8-Bit Serial Input	50V	500mA	Diode	A,B	CerDIP, PDIP, SOIC, PLCC
MIC5842 8-Bit Serial Input	80V	500mA	Diode	A,B	CerDIP, PDIP, SOIC, PLCC
MIC58P42 8-Bit Serial, Protected	70V	500mA	Diode	A,B	CerDIP, PDIP, SOIC, PLCC
MIC59P60 8-Bit Serial, Protected	70V	500mA	Diode	A,B	CerDIP, PDIP, SOIC, PLCC

Micrel

Ordering Information

MIC XXXX -01 A E B Q

Micrel
or Industry Std prefix

Part Number

Speed /Bonding Option
only used when required

Temperature
A = –55°C to +125°C
B = –40°C to +85°C
C = 0°C to +70°C

Package
E = Ceramic Quad
J = Ceramic DIP
L = Leadless Chip Carrier
M = 150 mil body SOIC
N = Plastic DIP
Q = QFP (Gull wing Quad Flat-Pak)
T = TO-220
V = PLCC
WM = Wide 300 mil body SOIC
Y = Dice
Z = TO-92

Screen Option
Industrial
B = Class B **S** = Class S

Qualification Option
H6 = Rad Hard, $1x10^6$ rad (Si)
Q = Class B or S

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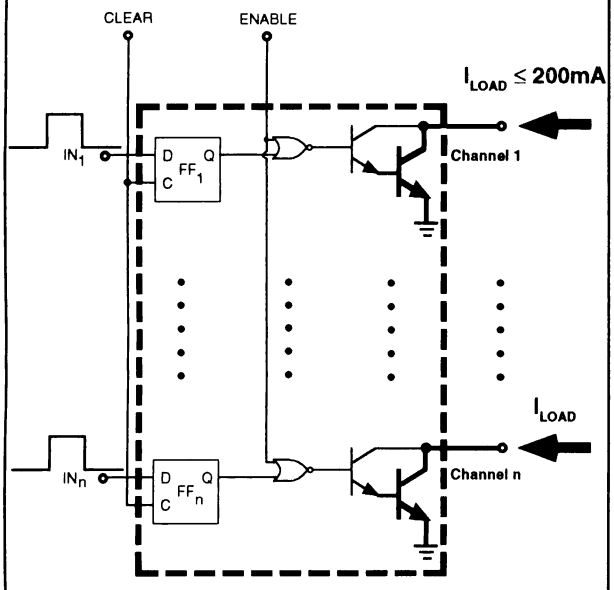
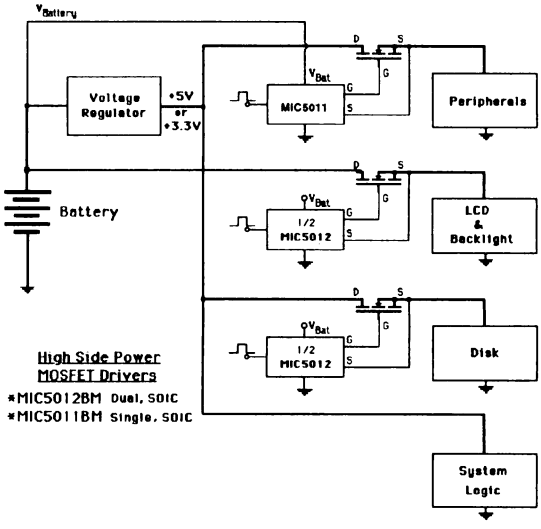
Latched Power Switching



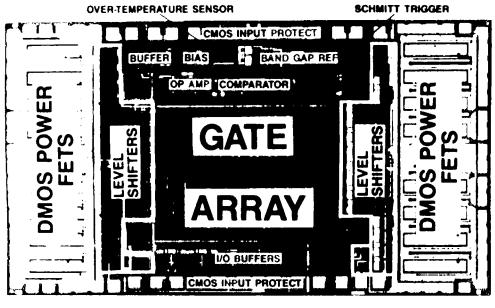
MIC5800/5801 Parallel Input Latched Drivers
MIC5821/5822, MIC5841/42 Serial Input Latched Drivers
4 or 8 Channels

Laptop Computer Power Management



Achieve greater battery life in laptop computer applications with high-efficiency power switching using MIC5010-series High-side power MOSFET drivers.

High Voltage Semicustom Power Array



MICREL MPD8020 CMOS/DMOS SEMICUSTOM HIGH VOLTAGE ARRAY

Features:
- 16 N-Channel DMOS power FETs, rated at 100V, 200mA
- 200 CMOS gates in an uncommitted gate array
- 12 TTL/CMOS I/O buffers
- Op amp, comparator, and Schmitt trigger macros
- Unity gain analog buffer
- Bandgap reference
- Over-temperature sensor
- Charge pump voltage multiplier
- 16 High voltage level shifters/ high side MOSFET drivers
- 16 medium current sink pre-drivers
- Separate analog and digital ground pads
- Numerous logic I/O, high voltage I/O, V_{CC} and V_{DD} pads
- Resistors, capacitors, and zeners
- Available to military temperature range specifications
- Selection of military, commercial, and power packages.

The MPD8020, Micrel's high voltage semicustom power array, combines digital, analog, and power MOSFETs on a single IC designed to allow the interface between low voltage control logic and high voltage (100V) high current (1A) loads. The MPD8020 gives a design engineer a highly versatile means of taking a circuit idea from concept to packaged silicon.

Kit parts are available which allow breadboarding and proof-of-concept testing before committing to a full design effort.

For your FREE copy of MICREL's full-line Data Book or for the name of your local representative or distributor, please contact:

Micrel Semiconductor
560 Oakmead Parkway
Sunnyvale, CA 94086
Phone: (408) 245-2500
FAX: (408) 245-4175

Micrel

256K x 4, 26 PIN SERIES SOJ

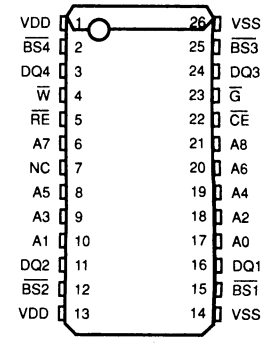
Configurations:

Part Number	Configuration
414256	256K x 4 Bit
413256	256K x 3 Bit
412256	256K x 2 Bit

Features:
- Page Mode
- Block Selects
- Output Enable
- Several Speeds Available
- Single +5 Volt +/- 10% Power Supply
- 26 Pin 300 mil Plastic SOJ Package

Pin Indentification:

Symbol	Function
AO-A8	Address Inputs
DQ1-DQ4	Data Inputs and Outputs
$\overline{BS1}$-$\overline{BS4}$	Block Selects
$\overline{RE}$	Row Address Strobe
$\overline{CE}$	Column Address Strobe
$\overline{G}$	Output Enable
$\overline{W}$	Write Enable (R/$\overline{W}$)
VSS	Ground
VDD	+5 Volt Power Supply
NC	No Connection



1 MEG x 4, 20 PIN SERIES SOJ

Configurations:

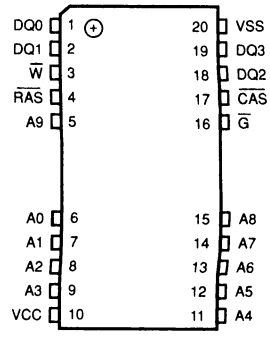
Part Number	Configuration
514400	1 Meg x 4 Bit
513300	1 Meg x 3 Bit
512400	512K x 4 Bit *

Features:
- Page Mode
- CBR Refresh (RAC)
- Late Write
- Several Speeds Available
- Single +5 Volt +/- 10% Power Supply
- 20 Pin 350 mil Plastic SOJ Package

Pin Indentification:

Symbol	Function
AO-A9	Address Inputs
DQ0-DQ3	Data Inputs and Outputs
$\overline{RAS}$	Row Address Strobe
$\overline{CAS}$	Column Address Strobe
$\overline{G}$	Output Enable
$\overline{W}$	Write Enable (R/$\overline{W}$)
VSS	Ground
VCC	+5 Volt Power Supply

* For 512K x 4 Configuration RAS Address A9=0



1 MEG x 4, 28 PIN SERIES SOJ

Configurations:

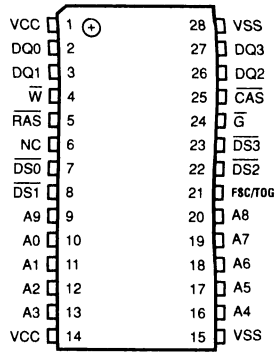
Part Number	Configuration
514400N	1 Meg x 4 Bit
513300N	1 Meg x 3 Bit
512512N	512K x 4 Bit *

Features:
- Page Mode
- Static Column Mode
- CBR Refresh (RAC)
- Data Selects
- Late Write
- Data Inhibit
- Several Speeds Available
- Single +5 Volt +/- 5% Power Supply
- 28 Pin 350 mil Plastic SOJ Package

Pin Indentification:

Symbol	Function
AO-A9	Address Inputs
DQ0-DQ3	Data Inputs and Outputs
$\overline{DS0}$-$\overline{DS3}$	Data Selects
$\overline{RAS}$	Row Address Strobe
$\overline{CAS}$	Column Address Strobe
FSC/TOG	Page or Static Column Mode
$\overline{G}$	Output Enable
$\overline{W}$	Write Enable (R/$\overline{W}$)
VSS	Ground
VCC	+5 Volt Power Supply
NC	No Connection

* For 512K x 4 Configuration RAS Address A9=0



256K x 8, 28 PIN SERIES SOJ

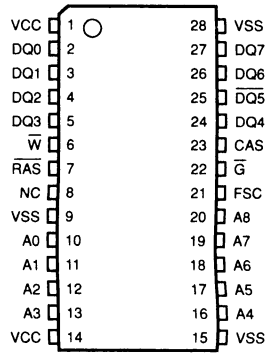
Configurations:

Part Number	Configuration
512256C	256K x 8 Bit

Features:
- Page Mode
- CBR Refresh (RAC)
- Late Write
- Several Speeds Available
- Single +5 Volt +/- 5% Power Supply
- 28 Pin 350 mil Plastic SOJ Package

Pin Indentification:

Symbol	Function
AO-A8	Address Inputs
DQ0-DQ7	Data Inputs and Outputs
$\overline{RAS}$	Row Address Strobe
CAS	Column Address Strobe
FSC	Page Mode
$\overline{G}$	Output Enable
$\overline{W}$	Write Enable (R/$\overline{W}$)
VSS	Ground
VCC	+5 Volt Power Supply
NC	No Connection



MICRO-C • 11085 Sorrento Valley Ct. • San Diego, California • 92121 • 619-552-1213 • Fax 619-552-1219

MICRON TECHNOLOGY, INC.

Micron Technology, Inc.
2805 E. Columbia Road, Boise, ID 83706
Telephone: (208) 368-3900 FAX: (208) 368-4431

Technical Leadership

Micron memory products represent the industry's highest achievement in memory technology with innovations like the award-winning Triple-Port DRAM, IC DRAM card and synchronous/pipelined/latched SRAMs-just to name a few. And Micron products are adapted to your applications by offering special features, low-power versions, wide configurations and the newest package types. Plus Micron always provides 100% burn-in of every unit with the unique AMBYX™ intelligent burn-in and test system-virtually eliminating infant mortality device failures.

Broad Product Line

Micron offers a wide range of products for virtually any memory application. In addition to being a full-spectrum DRAM supplier, Micron offers a variety of other memory products including multiport and specialty DRAMs; high-speed, specialty and cache data SRAMs; FIFOs; and SRAM and DRAM modules.

Features

- Very Fast Static RAMs: 1 Meg, 256K and 64K
- Cache Data Static RAMs: 8K x 16, 8K x 18
- Synchronous/Latched address SRAMs: 16K x 16, 16K x 18
- FIFO Memories: 2K x 9, 1K x 9 and 512 x 9
- Multiport Dynamic RAMs: 2 Meg, 1 Meg, 256K VRAMs and 1 Meg Triple Port DRAM
- Dynamic RAMs: 4 Meg, 1 Meg and 256K
- Specialty DRAMs: 256K x 4 Quad CAS, 64K x 16 and 256K x 16
- SRAM Modules: x32, x16, x 8 and custom organizations
- DRAM Modules: x36, x32, x9, x8 and custom organizations

Micron

MEMORY CONFIGURATION	OPTIONAL ACCESS CYCLE	PART NUMBER	ACCESS TIME	PACKAGE TYPE AND NUMBER OF PINS								
				PDIP	PLCC	PQFP	ZIP	SOJ	TSOP	CDIP	CLCC	FLAT PACK
DRAMs												
256K x 1	Page Mode	MT1259	100, 120, 150	16	18	-	16	-	-	16	18	16
1 Meg x 1	Fast Page Mode	MT4C1024	70, 80	18	-	-	20	20	-	18	-	18
1 Meg x 1	Static Column	MT4C1026	70, 80	18	-	-	20	20	-	18	-	18
4 Meg x 1	Fast Page Mode	MT4C1004	60, 70, 80	-	-	-	20	20	-	18	-	-
4 Meg x 4	Static Column	MT4C1006	60, 70, 80	-	-	-	20	20	-	18	-	-
64K x 4	Page Mode	MT4067	120, 150	18	18	-	-	18	-	18	18	-
256K x 4	Fast Page Mode	MT4C4256	70, 80	20	-	-	20	20	-	20	-	20
256K x 4	Static Column	MT4C4258	70, 80	20	-	-	20	20	-	20	-	20
1 Meg x 4	Fast Page Mode	MT4C4001	60, 70, 80	-	-	-	20	20	-	20	-	-
1 Meg x 4	Static Column	MT4C4003	60, 70, 80	-	-	-	20	20	-	20	-	-

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MEMORY CONFIGURATION	OPTIONAL ACCESS CYCLE	PART NUMBER	ACCESS TIME	PACKAGE TYPE AND NUMBER OF PINS								
				PDIP	PLCC	PQFP	ZIP	SOJ	TSOP	CDIP	CLCC	FLAT PACK
Specialty DRAMs												
256K x 4	Quad CAS	MT4C4259	70,80,100	-	-	-	-	26	-	-	-	-
1 Meg x 4	Quad CAS	MT4C4004	70,80,100	-	-	-	-	26	-	-	-	-
512K x 8	Fast Page Mode	MT4C8512/3	70,80,100	-	-	-	-	28	28	-	-	-
64K x 16	Fast Page Mode	MT4C1664/5	70,80,100	-	-	-	40	40	-	-	-	-
64K x 16	Static Column	MT4C1670/1	70,80,100	-	-	-	40	40	-	-	-	-
256K x 16	Fast Page Mode	MT4C16256/7	70,80,100	-	-	-	-	40	44	-	-	-
Dual Port DRAMs (VRAMs)												
64K x 4	Page Mode	MT42C4064	100,120,150	24	-	-	24	-	-	24	-	-
256K x 4	Fast Page Mode	MT42C4255	80,100,120	-	-	-	28	28	-	28	-	-
256K x 4	Fast Page Mode/ Block Write	MT42C4256	80,100,120	-	-	-	28	28	-	-	-	-
128K x 8	Fast Page Mode/	MT42C8127	80,100,120	-	-	-	-	40	-	-	-	-
128K x 8	Fast Page Mode/ Block Write	MT42C8128	80,100,120	-	-	-	40	40	-	-	-	-
256K x 8	Fast Page Mode/ Block Write	MT42C8256	70,80,90	-	-	-	-	40	-	-	-	-
Triple Port DRAMs												
256K x 4	Fast Page Mode/ Block Write	MT43C4257/8	80,100,120	-	-	-	-	40	-	-	-	-
128K x 8	Fast Page Mode/ Block Write	MT43C8128/9	80,100,120	-	52	-	-	-	-	-	-	-
SRAMs												
64K x 1	CE only	MT5C6401	12, 15, 20, 25, 30, 35	22	-	-	-	24	-	22	22	-
256K x 1	CE only	MT5C2561	15, 20, 25, 35, 45	24	-	-	-	24	-	24	28	-
1 Meg x 1	CE only	MT5C1001	20, 25, 30, 35, 45	28	-	-	-	28	28	28	28	28
16K x 4	CE only	MT5C6404	12, 15, 20, 25, 30, 35	22	-	-	-	24	-	22	22	-
16K x 4	CE & OE	MT5C6405	12, 15, 20, 25, 30, 35	24	-	-	-	24	-	24	28	-
16K x 4	Separate I/O, CE1, CE2	MT5C6406	12, 15, 20, 25, 30, 35	28	-	-	-	28	-	28	28	-
16K x 4	Separate I/O, High-Z	MT5C6407	12, 15, 20, 25, 30, 35	28	-	-	-	28	-	28	28	-
64K x 4	CE only	MT5C2564	15, 20, 25, 30, 35, 45	24	-	-	-	24	-	24	28	-

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MEMORY CONFIGURATION	OPTIONAL ACCESS CYCLE	PART NUMBER	ACCESS TIME	PACKAGE TYPE AND NUMBER OF PINS								
				PDIP	PLCC	PQFP	ZIP	SOJ	TSOP	CDIP	CLCC	FLAT PACK
SRAMs – (continued)												
64K x 4	CE & OE	MT5C2565	15, 20, 25, 35, 45	28	-	-	-	28	-	28	28	-
256K x 4	CE & OE	MT5C1005	20, 25, 30, 35, 45	28	-	-	-	28	28	28	28	28
8K x 8	CE1, CE2, & OE	MT5C6408	12, 15, 20, 25, 30, 35	28	-	-	-	28	-	28	32	-
32K x 8	CE & OE	MT5C2568	15, 20, 25, 35, 45	28	-	-	28	28	-	28	32	-
128K x 8	CE1, CE2, & OE	MT5C1008	20, 25, 30, 35, 45	32	-	-	-	32	32	32	32	32
128K x 8	CE1 & OE (Pin 30 NK)	MT5C1009	20, 25, 30, 35, 45	32	-	-	-	32	32	32	32	32
Latched SRAMs												
16K x 16	Latched Address	MT5C2516	15, 17, 20, 25	-	52	52	-	-	-	-	-	-
16K x 18	Latched Address	MT5C2818	15, 17, 20, 25	-	52	52	-	-	-	-	-	-
Synchronous SRAMs												
16K x 16	Synchronous	MT58C1616	15, 17, 20, 25	-	52	52	-	-	-	-	-	-
16K x 18	Synchronous	MT58C1618	15, 17, 20, 25	-	52	52	-	-	-	-	-	-
Cache Data SRAMs												
8K x 16		MT56C0816	20, 25, 35	-	52	52	-	-	-	-	-	-
8K x 16	A12 Latched	MT56C3816	20, 25, 35	-	52	52	-	-	-	-	-	-
8K x 18		MT56C0818	20, 25, 35	-	52	52	-	-	-	-	-	-
8K x 18	A12 Latched	MT56C3818	20, 25, 35	-	52	52	-	-	-	-	-	-
8K x 18	'486 Auto Write Termination	MT56C2818	24, 28	-	52	52	-	-	-	-	-	-
FIFOs												
512 x 9	Expandable	MT52C9005	15, 20, 25, 35	28	32	-	-	28	-	28	-	-
512 x 9	Programmable Flag	MT52C9007	15, 20, 25, 35	28	32	-	-	28	-	28	-	-
1K x 9	Expandable	MT52C9010	15, 20, 25, 35	28	32	-	-	28	-	28	-	-
1K x 9	Programmable Flag	MT52C9012	15, 20, 25, 35	28	32	-	-	28	-	28	-	-
2K x 9	Expandable	MT52C9020	15, 20, 25, 35	28	32	-	-	28	-	28	-	-
2K x 9	Programmable Flag	MT52C9022	15, 20, 25, 35	28	32	-	-	28	-	28	-	-

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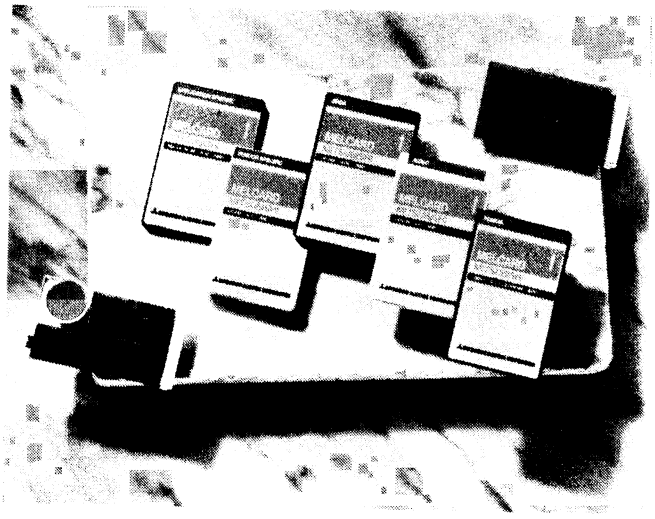
MEMORY CONFIGURATION	OPTIONAL ACCESS CYCLE	PART NUMBER	ACCESS TIME	PACKAGE TYPE AND NUMBER OF PINS				
				SIMM	SIP	ZIP	DIP	IC CARD
DRAM Modules								
256K x 8	Fast Page Mode	MT2D2568	70, 80, 100, 120	30	30	-	-	-
1 Meg x 8	Fast Page Mode	MT8D18	70, 80, 100	30	30	-	-	-
1 Meg x 8	Fast Page Mode	MT2D18	60, 70, 80, 100	30	30	-	-	-
4 Meg x 8	Fast Page Mode	MT8D48	60, 70, 80	30	30	-	-	-
256K x 9	Fast Page Mode/ Page Mode	MT3D2569	70, 80, 100, 120	30	30	-	-	-
1 Meg x 9	Fast Page Mode	MT9D19	70, 80, 100	30	30	-	-	-
1 Meg x 9	Fast Page Mode	MT3D19	70, 80, 100	30	30	-	-	-
4 Meg x 9	Fast Page Mode	MT9D49	60, 70, 80	30	30	-	-	-
256K x 32	Fast Page Mode	MT8D25632	70, 80, 85, 100	72	-	-	-	-
512K x 32	Fast Page Mode	MT16D51232	70, 80, 85, 100	72	-	-	-	-
1 Meg x 32	Fast Page Mode	MT8D132	70, 80, 100	72	-	-	-	-
2 Meg x 32	Fast Page Mode	MT16D232	70, 80, 100	72	-	-	-	-
256K x 36	Fast Page Mode	MT9D25636	70, 80, 85, 100	72	-	-	-	-
256K x 36	Fast Page Mode	MT10D25636	70, 80, 85, 100	72	-	-	-	-
512K x 36	Fast Page Mode	MT18D51236	70, 80, 85, 100	72	-	-	-	-
512K x 36	Fast Page Mode	MT20D51236	70, 80, 85, 100	72	-	-	-	-
1 Meg x 36	Fast Page Mode	MT12D136	70, 80, 100	72	-	-	-	-
2 Meg x 36	Fast Page Mode	MT24D236	70, 80, 100	72	-	-	-	-
IC DRAM Cards								
256K x 36/ 512K x 18	Fast Page Mode	MT12DC25636	70, 80, 100	-	-	-	-	88
512K x 36/ 1 Meg x 18	Fast Page Mode	MT24DC51236	70, 80, 100	-	-	-	-	88
1 Meg x 36/ 2 Meg x 18	Fast Page Mode	MT12DC136	70, 80, 100	-	-	-	-	88
2 Meg x 36/ 1 Meg x 18	Fast Page Mode	MT24DC236	70, 80, 100	-	-	-	-	88
SRAM Modules								
128K x 8	CE & OE	MT4S1288	30, 35	-	-	-	32	-
32K x 16	CE & OE	MT2S3216	30, 35	-	-	-	40	-
64K x 16	CE & OE	MT4S6416	30, 35	-	-	-	40	-
16K x 32	CE & OE	MT8S1632	15, 20, 25, 30	64	-	64	-	-
64K x 32	CE & OE	MT8S6432	20, 25, 30, 35	64	-	64	-	-
128K x 32	CE & OE	MT4S12832	25, 35	64	-	64	-	-
256K x 32	CE & OE	MT8S25632	25, 35	64	-	64	-	-

MEMORY CARDS

Mitsubishi memory cards offer the highest density, solid-state memory available in a credit card size (86mm x 54mm x 3.3mm). With up to 12 megabytes of memory and nanosecond speeds, Mitsubishi cards give you the access times and capacities to challenge traditional magnetic media storage options.



SRAM Cards

WITH BATTERY MONITOR PIN AND WRITE-PROTECT SWITCH

Part Number	Memory Capacity (KB)	Data Bus Width (Bits)	Access Time (ns)	Connector Type	No. of Pins
MF332A-MBDACXX	32	8	200	Card Edge	50
MF332A-MADAPXX	32	8	200	Two-Piece	60
MF364A-M7DACXX	64	8	200	Card Edge	50
MF364A-M6DAPXX	64	8	200	Two-Piece	60
MF3128-M7DACXX	128	8	200	Card Edge	50
MF3128-M6DAPXX	128	8	200	Two-Piece	60
MF3256-M7DACXX	256	8	200	Card Edge	50
MF3256-M6DAPXX	256	8	200	Two-Piece	60
MF3512-M7DACXX	512	8	200	Card Edge	50
MF3512-M6DAPXX	512	8	200	Two-Piece	60
MF31M0-M7DACXX	1024	8	200	Card Edge	50
MF31M0-M6DAPXX	1024	8	200	Two-Piece	60
MF32M0-M7DACXX	2048	8	200	Card Edge	50
MF32M0-M6DAPXX	2048	8	200	Two-Piece	60
MF365A-M7DACXX	64	16	200	Card Edge	50
MF365A-M6DAPXX	64	16	200	Two-Piece	60
MF365A-L2DATXX	64	8/16	200	Two-Piece	68
MF3129-M7DACXX	128	16	200	Card Edge	50
MF3129-M6DAPXX	128	16	200	Two-Piece	60
MF3129-L2DATXX	128	8/16	200	Two-Piece	68
MF3257-M7DACXX	256	16	200	Card Edge	50
MF3257-M6DAPXX	256	16	200	Two-Piece	60
MF3257-L2DATXX	256	8/16	200	Two-Piece	68
MF3513-M7DACXX	512	16	200	Card Edge	50
MF3513-M6DAPXX	512	16	200	Two-Piece	60
MF3513-L2DATXX	512	8/16	200	Two-Piece	68
MF31M1-M7DACXX	1024	16	200	Card Edge	50
MF31M1-M6DAPXX	1024	16	200	Two-Piece	60
MF31M1-L2DATXX	1024	8/16	200	Two-Piece	68
MF32M1-M7DACXX	2048	16	200	Card Edge	50
MF32M1-M6DAPXX	2048	16	200	Two-Piece	60
MF32M1-L2DATXX	2048	8/16	200	Two-Piece	68

XX:00 = Blank Panel Artwork 01 = Mitsubishi Panel Artwork Other = Custom Electrical, Mechanical, and/or Artwork

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ELECTRONIC DEVICE GROUP
(408) 730-5900 Ext: 2106

MEMORY CARDS

MITSUBISHI
ELECTRONIC DEVICE GROUP

DRAM Cards

Part Number	Memory Capacity (KB)	Data Bus Width (Bits)	Access Time (ns)	Connector Type	No. of Pins
MF1513-M1CAPXX	512	16	150	Two-Piece	60
MF11M1-M1CAPXX	1024	16	150	Two-Piece	60
MF12M1-M1CAPXX	2048	16	150	Two-Piece	60
MF13M1-M1CAPXX	3072	16	150	Two-Piece	60
MF14M1-M1AAPXX	4096	16	100	Two-Piece	60
MF18M1-M1AAPXX	8192	16	100	Two-Piece	60
MF112M-M1AAPXX	12,288	16	100	Two-Piece	60
MF11M1-978APXX	1024	18	80	Two-Piece	60
MF14M1-978APXX	4096	18	80	Two-Piece	60
MF14M1-L28ATXX	4096	36	80	Two-Piece	88
MF18M1-L28ATXX	8192	36	80	Two-Piece	88

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OTPROM Cards

Part Number	Memory Capacity (KB)	Data Bus Width (Bits)	Access Time (ns)	Connector Type	No. of Pins
MF4128-F4EACXX	128	8	250	Card Edge	50
MF4128-F3EAPXX	128	8	250	Two-Piece	60
MF4256-F4EACXX	256	8	250	Card Edge	50
MF4256-F3EAPXX	256	8	250	Two-Piece	60
MF4512-F4EACXX	512	8	250	Card Edge	50
MF4512-F3EAPXX	512	8	250	Two-Piece	60
MF41M0-F2EACXX	1024	8	250	Card Edge	50
MF41M0-F1EAPXX	1024	8	250	Two-Piece	60
MF42M0-F2EACXX	2048	8	250	Card Edge	50
MF42M0-F1EAPXX	2048	8	250	Two-Piece	60
MF44M0-F2EACXX	4096	8	250	Card Edge	50
MF44M0-F1EAPXX	4096	8	250	Two-Piece	60
MF4129-F4EACXX	128	16	250	Card Edge	50
MF4129-F3EAPXX	128	16	250	Two-Edge	60
MF4257-F4EACXX	256	16	250	Card Edge	50
MF4257-F3EAPXX	256	16	250	Two-Piece	60
MF4257-G1EATXX	256	8/16	250	Two-Piece	68
MF4513-F4EACXX	512	16	250	Card Edge	50
MF4513-F3EAPXX	512	16	250	Two-Piece	60
MF4513-G1EATXX	512	8/16	250	Two-Piece	68
MF41M1-F2EACXX	1024	16	250	Card Edge	50
MF41M1-F1EAPXX	1024	16	250	Two-Piece	60
MF41M1-G1EATXX	1024	8/16	250	Two-Piece	68
MF42M1-F2EACXX	2048	16	250	Card Edge	50
MF42M1-F1EAPXX	2048	16	250	Two-Piece	60
MF42M1-G1EATXX	2048	8/16	250	Two-Piece	68
MF44M1-F2EACXX	4096	16	250	Card Edge	50
MF44M1-F1EAPXX	4096	16	250	Two-Piece	60
MF44M1-G1EATXX	4096	8/16	250	Two-Piece	68

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MEMORY CARDS

Flash EEPROM Cards

Part Number	Memory Capacity (KB)	Data Bus Width (Bits)	Access Time (ns)	Connector Type	No. of Pins
MF8257-G1EATXX	256	8/16	250	Two-Piece	68
MF8513-G1EATXX	512	8/16	250	Two-Piece	68
MF81M1-G1EATXX	1024	8/16	250	Two-Piece	68
MF82M1-G1EATXX	2048	8/16	250	Two-Piece	68

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EEPROM Cards

Part Number	Memory Capacity (KB)	Data Bus Width (Bits)	Access Time (ns)	Connector Type	No. of Pins
MF808A-F1EAPXX	8	8	250	Two-Piece	60
MF816A-F1EAPXX	16	8	250	Two-Piece	60
MF832A-F1EAPXX	32	8	250	Two-Piece	60
MF864A-F1EAPXX	64	8	250	Two-Piece	60
MF8128-F1EAPXX	128	8	250	Two-Piece	60
MF8192-F1EAPXX	192	8	250	Two-Piece	60

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Masked ROM Cards

Part Number	Memory Capacity (KB)	Data Bus Width (Bits)	Access Time (ns)	Connector Type	No. of Pins
MF7512-F2FACXX	512	8	300	Card Edge	50
MF7512-F1FAPXX	512	8	300	Two-Piece	60
MF71M0-F2FACXX	1024	8	300	Card Edge	50
MF71M0-F1FAPXX	1024	8	300	Two-Piece	60
MF72M0-F2FACXX	2048	8	300	Card Edge	50
MF72M0-F1FAPXX	2048	8	300	Two-Piece	60
MF74M0-F2FACXX	4096	8	300	Card Edge	50
MF74M0-F1FAPXX	4096	8	300	Two-Piece	60
MF78M0-F2FACXX	8192	8	300	Card Edge	50
MF78M0-F1FAPXX	8192	8	300	Two-Piece	60
MF7513-F2FACXX	512	16	300	Card Edge	50
MF7513-F1FAPXX	512	16	300	Two-Piece	60
MF71M1-F2FACXX	1024	16	300	Card Edge	50
MF71M1-F1FAPXX	1024	16	300	Two-Piece	60
MF71M1-G1DATXX	1024	8/16	200	Two-Piece	68
MF72M1-F2FACXX	2048	16	300	Card Edge	50
MF72M1-F1FAPXX	2048	16	300	Two-Piece	60
MF72M1-G1DATXX	2048	8/16	200	Two-Piece	68
MF74M1-F2FACXX	4096	16	300	Card Edge	50
MF74M1-F1FAPXX	4096	16	300	Two-Piece	60
MF74M1-G1DATXX	4096	8/16	200	Two-Piece	68
MF78M1-F2FACXX	8192	16	300	Card Edge	50
MF78M1-F1FAPXX	8192	16	300	Two-Piece	60
MF78M1-G1DATXX	8192	8/16	200	Two-Piece	68
MF716M-G1DATXX	16,384	8/16	200	Two-Piece	68

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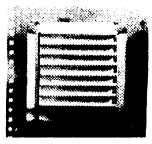
Products subject to availability

GATE ARRAYS

MITSUBISHI
ELECTRONIC DEVICE GROUP

Next-generation system designs require extremely high gate densities in submicron technology. Mitsubishi has responded with its 0.8 µm gate arrays. Designed with triple-layer metal CMOS processes and sea-of-gates architecture, Mitsubishi's 0.8 µm arrays offer 400,00 gates, with a utilization rate of over 60%, or 250,000 gates. Mitsubishi also offers 1.0 µm, 1.3 µm and; 2.0 µm gate arrays.



M6007X and M6008X Series 0.8µm (preliminary)

Part Number			M60071	M60072	M60073	M60074	M60075	M60076	M60080L	M60081L	M60082L	M60083L	M60084L	M60084H	M60085H	M60086H	M60087H	M60088H	M60089H
Number of Usable Gates (with memory)														90K	105K	120K	150K	192K	250K
Number of Usable Gates (without memory)			6K	8K	10K	12K	15K	20K	25K	30K	35K	40K	50K	60K	70K	80K	100K	120K	150K
Package Type	**Lead Pitch**	**Pins**																	
Plastic Quad Flat Package (QFP)	0.80mm	80	♦	♦	♦														
	0.65mm	100	♦	♦	♦														
	0.80mm	120	♦	♦	♦	♦	♦	♦	♦	♦	♦	♦	♦						
	0.65mm	136	♦	♦	♦	♦	♦	♦	♦	♦	♦	♦	♦						
	0.65mm	160		♦	♦	♦	♦	♦	♦	♦	♦	♦	♦	♦	♦				
	0.50mm	208				♦	♦	♦			♦	♦	♦	♦	♦	♦	♦		
	0.50mm	256														♦	♦	♦	♦
	0.50mm	304																	♦
TAB Plastic Quad Flat Package (TAB QFP)	0.25mm	328												♦	♦	♦	♦	♦	♦
	0.25mm	432												♦	♦	♦	♦	♦	♦
	0.25mm	480															♦	♦	♦
	0.25mm	576															♦	♦	♦
Ceramic Pin Grid Array (PGA)	100mil	177											♦						
	100mil	209												♦					
	100mil	281													♦	♦	♦		
	100mil	393																♦	♦

M6005X and M6006X Series 1.0µm

Part Number			M60050	M60051	M60052	M60053	M60054	M60055	M60056	M60057	M60062	M60063	M60064	M60065	M60066	M60067
Number of Usable Gates			5,000	6,000	8,000	10,000	12,000	15,000	25,000	35,000	3,000	4,000	5,000	6,000	8,000	10,000
Maximum I/O Ports			112	120	128	150	166	176	216	234	128	150	150	150	150	176
Package Type	**Lead Pitch**	**Pins**														
Plastic Quad Flat Package (QFP)	0.80mm	80	♦	♦	♦	♦										
	0.65mm	100	♦	♦	♦	♦	♦									
	0.80mm	120		♦	♦	♦	♦	♦			♦	♦				
	0.65mm	136			♦	♦	♦	♦	♦		♦	♦	♦			
	0.65mm	160				♦	♦	♦	♦	♦		♦	♦	♦	♦	♦
	0.50mm	208						♦	♦	♦						♦
Plastic Leaded Chip Carrier (PLCC)	50mil	68	♦	♦	♦	♦	♦	♦								
	50mil	84	♦	♦	♦	♦	♦	♦								
Ceramic Pin Grid Array (PGA)	100mil	281								♦						

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Cached DRAM with 50 to 100 MHz Performance at 4Mb Density

M5M44409TP-10,-15,-20 Cached DRAM

Target Spec. (Rev. 1.0)

DESCRIPTION

The M5M44409TP is a 4M-bit Cached DRAM (CDRAM), that integrates input registers, a 1048576-word by 4-bit dynamic memory array, and a 4096-word by 4-bit SRAM as a Cache memory (block size 16 x 4), onto a single monolithic circuit. The block transfer between array and cache is performed in one array cycle, providing advantages over the conventional combination of the DRAM and SRAM cache.

The RAM is fabricated with the high performance CMOS process, and is ideal for large-capacity memory systems where high speed, low power dissipation, and cost effectiveness are critical. The use of quadruple-layer polysilicon process combined with double aluminum wiring technology, a single-transistor dynamic storage stacked capacitor cell and six-transistor static storage cell, provide high circuit density at reduced costs.

FEATURES

Type Name	Cache Hit Access/cycle	Cache Miss Access/cycle	Direct Array Access/cycle	Power Dissipation
M5M44409TP-10	10ns/10ns	70ns/(280ns)*	70ns/140ns	Cache: 737mW Array: 360mW
M5M44409TP-15	15ns/15ns	75ns/(300ns)*	75ns/150ns	Cache: 556mW Array: 336mW
M5M44409TP-20	20ns/20ns	80ns/(320ns)*	80ns/160ns	Cache: 369mW Array: 314mW

*Miss cycle after access time can be hidden in Hit cycle

- Applicable for direct mapped and associative cache memory systems.
- Synchronous design for precise cycle control with an external clock (K).
- Registered inputs controlled by K.
- Asynchronous output enable (G#) for bus control.
- Multiplexed array address inputs for reduced pin-count and higher system densities.
- Separate array and cache address inputs for fast cache hit access.
- Selectable output operation (transparent/latch/registered) and I/O configuration (separate D/Q/masked write) by command registers.
- Fast Copy Back for cache miss access time equal to array access time.
- Selectable operation (Low Power Operation or High Speed Operation) by command registers.
- Low Power Operation for intermittent toggling of K to save power.
- Write-through miss write operation for better coherency.
- REF# auto refresh for dynamic memory array.
- Packaging 300 mil, 44-pin Thin Small Outline Package (TSOP type II), with 0.8mm lead pitch and 18.4mm package length (only 7% longer than conventional 4M DRAM).

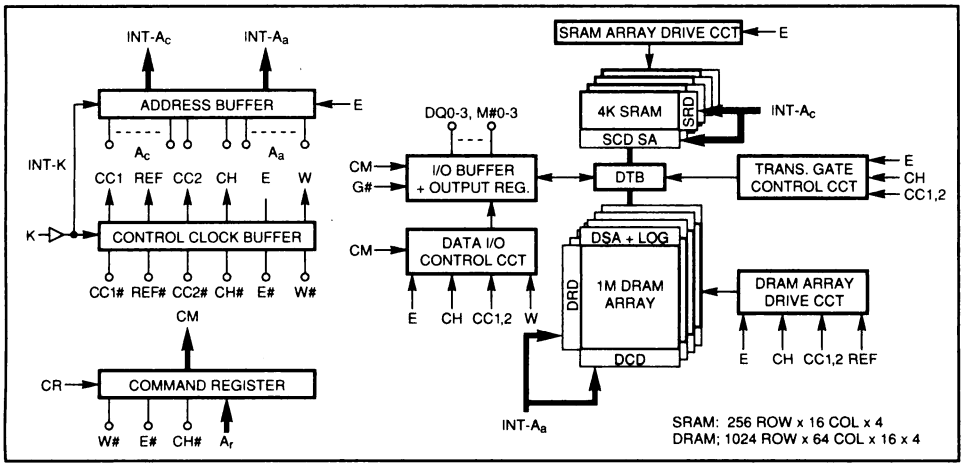
PIN CONFIGURATION (TOP VIEW)

1) Separate D/Q - For systems with ECC.
2) Masked Write - For systems with parity.

Masked Write	Separate D/Q				Separate D/Q	Masked Write
	V_{cc}	1		44	REF#	
	A_a0	2		43	A_a9	
	A_a1	3		42	A_a8	
	CC1#	4		41	K	
	W#	5		40	G#	
	A_c0/A_r0	6		39	A_c11	
	A_c1/A_r1	7		38	A_c10	
	A_c2	8		37	A_c9	
M#0	D0	9	300mil	36	D3	M#3
DQ0	Q0	10	TSOP	35	Q3	DQ3
	V_{cc}	11	Type II	34	GND	
	GND	12	0.8mm	33	V_{cc}	
DQ1	Q1	13	Lead Pitch	32	Q2	DQ2
M#1	D1	14		31	D2	M#2
	A_c3	15		30	A_c8	
	A_c4	16		29	A_c7	
	A_c5	17		28	A_c6	
	E#	18		27	CH#	
	A_a1	19		26	A_a7	
	A_a3	20		25	A_a6	
	A_a4	21		24	A_a5	
	GND	22		23	CC2#	

Conv. 4M DRAM

BLOCK DIAGRAM



K	:Master Clock
E#	:Chip Select
CH#	:Cache Hit
W#	:Write Enable
M#	:Mask Enable
G#	:Output Enable
REF#	:Refresh
CC1#, 2#	:Control Inputs for Array Access & Command Register
A_a	:Array Address
A_r	:Register Address
A_c	:Cache Address
D	:Data Input
Q	:Data Output
DQ	:Data I/O
V_{cc}	:Power Supply
GND	:Ground

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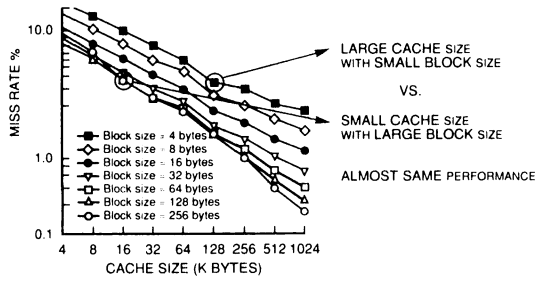
4Mb Cached DRAM (CDRAM)

Concept


MISS RATE %
10.0
1.0
0.1
4 8 16 32 64 128 256 512 1024
CACHE SIZE (K BYTES)
Block size = 4 bytes
Block size = 8 bytes
Block size = 16 bytes
Block size = 32 bytes
Block size = 64 bytes
Block size = 128 bytes
Block size = 256 bytes
LARGE CACHE SIZE WITH SMALL BLOCK SIZE
VS.
SMALL CACHE SIZE WITH LARGE BLOCK SIZE
ALMOST SAME PERFORMANCE

Source of figure A: Agarwal et al. "Cache performance of Operating System and Multiprogramming Workloads." ACM Trans. on Comp. Sys. vol 6, No 4, Nov. 1988. p425

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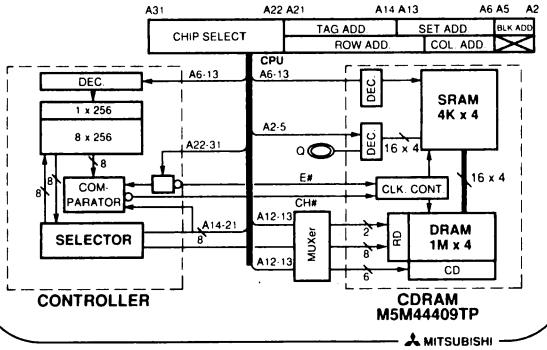
- Large cache ⟶ Lower miss rate
- Larger block size ⟶ Lower miss rate

16K-byte cache block size 64 bytes (4MB CDRAM) = (hit rate) 128K-byte cache block size 4 bytes (32K x 8 x 4 and 4MB DRAM)

- The CDRAM contains a smaller cache. But because it has large block size, it provides equal hit rate performance as a larger cache.

4Mb Cached DRAM (CDRAM)

Block Diagram in a Direct Mapped System



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- Basic system: 8 CDRAMs, Controller, Address MUXer (min. 4MB)
- Controller: 8 x 256b TAG memory, 1 x 256b Valid Bit memory, Decoder, Comparator, Selector.
- A22-31: Chip Select signal to control E#.
- A2-21: Address signal for CDRAM and Controller
  Cache Address Block Address: A2-5 Set Address: A6-13
  Tag Address: A14-21
  Array Address Column Address: A6-11 Row Address: A12-21
- Tag Memory output 8b to Comparator if corresponding address is valid.
- Comparator makes CH # low if 8b coincide with A14-21 (Cache Hit).

(Cache Hit) CDRAM: Cache Hit Cycle
Accessible to 1b x 4 selected by block address out of 16b x 4 selected by SRAM row decoder.

(Cache Miss) CDRAM: Block Transfer Cycle followed by a copy Back Cycle (if needed) Selector outputs 8b of TAG memory to DRAM row decoder and reloads A14-21 to TAG memory.

4Mb Cached DRAM (CDRAM)

Essential Advantage

over the combination of the conventional DRAM and SRAM cache.

Block transfer (16 bits X 4)

between array and cache

performed in one array cycle

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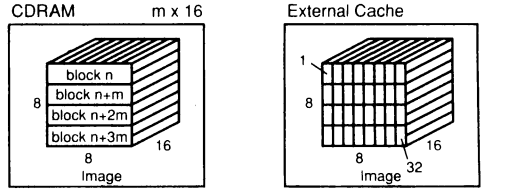
- The CDRAM transfers 16 data entries between the cache and array in one array cycle. The conventional DRAM and SRAM cache, on the other hand, can transfer only one entry per memory cycle. Consequently, the CDRAM can have 16 times the bandwidth as that of the conventional configuration. Its miss cycle penalty, thus, becomes much less.
- Miss cycle penalty:
  (based on a 5% miss rate, 80ns DRAM access, 40ns fast-page mode DRAM access, and 20ns SRAM access)

Block Size	Average Access Time SRAM + DRAM	CDRAM
4B	18ns	—
16B	24ns	—
32B	34ns	—
64B	63ns	18ns

4Mb Cached DRAM (CDRAM)

Large Data Structure/ Image Processing



One Pass 4/32 = 12% miss rate
Three Pass 4/32 = 4%

One Pass 32/32 = 100% miss rate
Three Pass 32/(32x3) = 33%

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Block	Cache Type	Misses/Total Accesses	= Miss Rate
8 x 8	CDRAM	4/32 (one pass) 4/32 x 3 (3 passes)	= 12% = 4%
	Ext. SRAM	32/32 (one pass) 32/32 x 3 (3 passes)	= 100% = 33%

- The CDRAM fill time is very quick making it a good fit for large data structures.
- Traditional caches cannot process large data structures very efficiently because they are easily over run.

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Tel: 1-800-632-3531, FAX: 1-800-729-9288

ASIC CAD SELECTION CARD

SCHEMATIC EDITOR/ SIMULATOR, ETC.	EWS	NEC ASIC PRODUCT LIBRARY																
		CMOS-6V	CMOS-6A	CMOS-6	CMOS-5	CMOS-5U	CMOS-5V	CMOS-4	CMOS-4A	CMOS-4R	BiCMOS-5	BiCMOS-4	BiCMOS-4A	ECL-4A	ECL-4	SC-5	CB-C7		
DAZIX	Logician		1.3	1.3	1.6	1.6	1.6	4.9	4.3	1.1	1.0	1.6	1.1			1.0		
	Personal Logician		1.3	1.3	1.6	1.6	1.6	4.9	4.3	1.1	1.0	1.6	1.1			1.0		
	Sun 386i		1.3	1.3	1.6	1.6	1.6	4.9	4.3	1.1	1.0	1.6	1.1			1.0		
	Sun 4		1.3	1.3	1.6	1.6	1.6	4.9		1.1	1.0	1.6	1.1			1.0		
HILO	VAX II			1.12	1.12	1.31	1.31	1.01	1.01		1.2			2.0		1.42		
SYSTEM HILO	HP				3.2	3.2	3.2	3.2	3.2		1.2	3.2	3.2	2.0	3.2	1.42		
	Sun 3/4			1.12	1.31	1.31	1.31	1.01	1.01		1.2			2.0		1.42		
IKOS	IKOS		1.1	1.1	1.1	1.1	1.1				0.9							
MENTOR GRAPHICS	Apollo DN460/660		1.21	1.21	1.61	1.61	1.61	3.6	3.6		1.0	1.9	1.9			1.0		
	Apollo DN 3XXX/4XXX		1.21	1.21	1.61	1.61	1.61	3.6	3.6		1.0	1.9	1.9			1.0		
	Apollo DN10000		1.21	1.21	1.61	1.61	1.61	3.6	3.6		1.0	1.9	1.9			1.0		
NECSIM/ NEXPLUS	Zycad XP-XXX	2.84	2.84	2.84	2.61	2.61	2.61	2.60	2.60	2.60	2.6	1.0	1.0	0.2		2.6	1.0	
POWERSIM	Zycad XP-XXX	2.10	2.10	2.10	1.11	1.11	1.11									1.10	1.0	
SYNOPSYS	Sun 3	2.0	2.0	2.0	1.02	1.02	1.02				1.01					1.02	1.02	
	Sun 4/ SPARC	2.0	2.0	2.0	1.02	1.02	1.02				1.01					1.02	1.02	
VALID	DEC 3100	1.35	1.35	1.35	2.24	2.24	2.24	4.9	4.5		0.93	4.5	1.2	1.0	1.0	1.0		
	IBM AT	1.35	1.35	1.35	2.24	2.24	2.24	4.9	4.5		0.93	4.5	1.2	1.0	1.0	1.0		
	Sun 3/4	1.35	1.35	1.35	2.24	2.24	2.24	4.9	4.5		0.93	4.5	1.2	1.0	1.0	1.0		
VERILOG	Sun 3/4	3.0a	3.0a	3.0a	2.2	2.2	2.2				3.0a					1.02	1.02	
VERITIME	Sun 3/4	3.0a	3.0a	3.0a	2.2	2.2	2.2				3.0a					1.02	1.02	
VERIFAULT	Sun 3/4	3.0a	3.0a	3.0a														
VIEWLOGIC	IBM AT	1.02	1.02	1.02	2.01	2.01	2.01	1.01	1.01		1.00							
	Sun 4	1.02	1.02	1.02	2.01	2.01	2.01	1.01	1.01		1.00							

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[XX] Library Revision Number
[ ] Under Development

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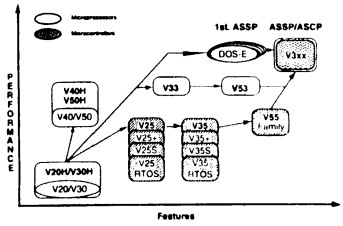
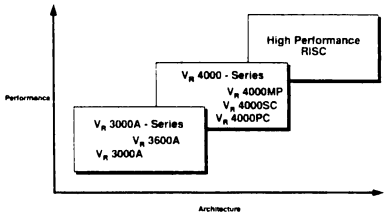
Microprocessor V-V_R Series	**8-Bit/16-Bit**	**V20, V30, V40, V50, V20HL, V30HL, V40H, V50H**
		V25/V35, V53, V55, V3X, V3XX
	RISC	**V_R3000A, V_R3010A, V_R3600A, V_R4000**

V-Series

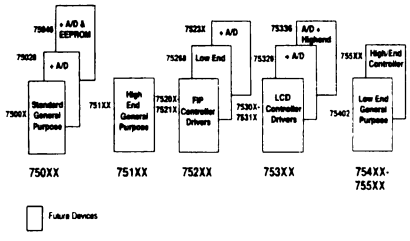


V_R - Series

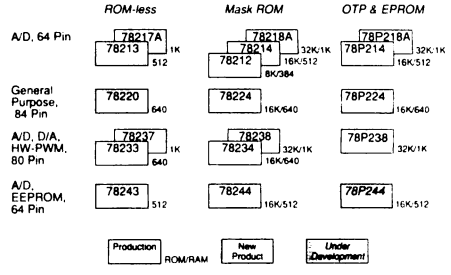


Single-Chip Microcomputer 75X Series K-Series	**4-Bit**	**75X Series**	**General Purpose**	**750XX, 751XX, 755XX**
			Vacuum Florescence	**752XX**
			LCD	**753XX**
			Telecom	**756XX**
	8-Bit	**78C1X, 78K0, 78K2 series**		
	16-Bit	**78K3, 78350 series**		

75X Series

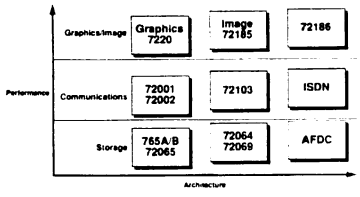


78K2 Family

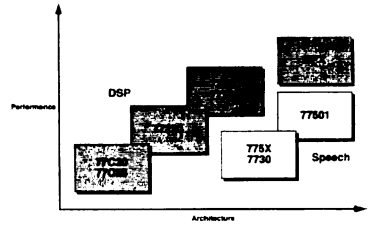


Intelligent Peripheral Devices	**Storage Communications Graphics/Image**	**765B, 72065, 72064, 72069, AFDC 72001/2, 72103, ISDN 7220, 72120, 72123, 72185, 72186,72181**
DSP and Speech		**77C20/C25, 77220, 77230/240, SPX 775X, 7730, 77501, 77521**

Intelligent Peripherals (IPD)



DSP/Speech



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NEC MEMORY

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APPLICATION-SPECIFIC MEMORY DEVICES

Number	Organization	Access Times	Packages
µPD41101	910 x 8	27 to 49 ns	DIP, Miniflat
102	1135 x 8	21 to 40 ns	DIP, Miniflat
µPD41264	64K x 4 (VRAM)	120, 40/150, 60	DIP, ZIP
µPD42101	910 x 8	27 to 49 ns	DIP, Miniflat
102	1135 x 8	21 to 40 ns	DIP, Miniflat
264	64K x 4 (VRAM)	100, 30	DIP, ZIP
270	910 x 263 x 4	40 ns	DIP
272	22KW x 6b (PIP)	25 ns	QFP
µPD42274	256K x 4 (VRAM)	100, 30/120, 40	SOJ, ZIP
275	128K x 8 (VRAM)	80 to 220 ns	SOJ
505	5048 x 8	40 to 55 ns	DIP
532	32K x 8	50 ns	DIP
µPD42601	1M x 1 (Silicon File)	600 ns	DIP, SOJ, ZIP
641	4M x 1 (Silicon File)	80 ns	SOJ
µPD42644	1M x 4 (Silicon File)	80 ns	SOJ
µPD43501	2 x 1K x 8	60 ns	PGA
µPD42608	512 x 32 x 4	64 ns	PGA

DRAM MODULES

MC157	256K x 8	100 ns	SIMM
MC41256A9A/B	256K x 9	80 to 100 ns	SIMM
MC42256AA9B/F	256K x 9 (page)	80 to 100 ns	SIMM
B9B/F	256K x 9	60 to 100 ns	SIMM
B9BA/FA	256K x 9 (fast-page)	60 to 100 ns	SIMM
32B/F	256K x 32 (fast-page)	60 to 100 ns	SIMM
32BT/FT	256K x 32 (fast-page)	60 to 100 ns	SIMM
36B/F	256K x 36 (page)	60 to 100 ns	SIMM
MC424256A36B/F	256K x 36 (page)	80 to 100 ns	SIMM
MC424256A36BH/FH	256K x 36 (fast-page)	60, 80, 100 ns	SIMM
MC42512A32B/F	512K x 32 (fast-page)	60 to 100 ns	SIMM
32BT/FT	512K x 32 (fast-page)	60 to 100 ns	SIMM
MC424512A36B/F	512K x 36 (page)	80 to 100 ns	SIMM
A36BH/FH	512K x 36 (fast-page)	60 to 100 ns	SIMM
MC42256AA40B/F	256K x 40 (fast-page)	60, 80, 100 ns	SIMM
MC42512A36B/F	512K x 36 (fast-page)	60 to 100 ns	SIMM
A40B/F	512K x 40 (fast-page)	60 to 100 ns	SIMM
B40B/F	512K x 40 (fast-page)	70 to 100 ns	SIMM
MC421000A8A/B/F	1M x 8 (fast-page)	60 to 100 ns	SIMM
A8AA/BA/FA	1M x 8 (fast-page; 2-chip solution)	60 to 100 ns	SIMM
B8AB/BB/FB	1M x 8 (fast-page; 2-chip solution)	70 to 100 ns	SIMM
A9A/B	1M x 9 (fast-page)	60 to 100 ns	SIMM
A9AA/BA/FA	1M x 9 (fast-page; 3-chip solution)	60 to 100 ns	SIMM
A9AB/BB/FB	1M x 9 (fast-page; 3-chip solution)	70 to 100 ns	SIMM
A9AC/BC/FC	1M x 9	60 to 100 ns	SIMM
A32B/F	1M x 32 (fast-page); 1" high	60 to 100 ns	SIMM
A32BH/FH	1M x 32 (fast-page)	60 to 100 ns	SIMM
A36B/F	1M x 36 (fast-page); 1" high	60 to 100 ns	SIMM
A36BD/FD	1M x 36 (fast-page); 1" high	60 to 100 ns	SIMM
A36BH/FH	1M x 36 (fast-page)	60 to 100 ns	SIMM
A36BT/FT	1M x 36 (fast-page; TSOP)	60 to 100 ns	SIMM
AA40B/F	1M x 40 (fast-page)	60 to 100 ns	SIMM
AB40B/F	1M x 40 (5 pc, 512K x 8)	70 to 100 ns	SIMM
MC422000A32B/F	2M x 32 (fast-page); 1" high	60 to 100 ns	SIMM
A32BH/FH	2M x 32 (fast-page)	60 to 100 ns	SIMM
A36B/F	2M x 36 (fast-page)	60 to 100 ns	SIMM
A36BH/FH	2M x 36 (fast-page)	60 to 100 ns	SIMM
A36BT/FT	2M x 36 (fast-page; all TSOP)	60 to 100 ns	SIMM
AA40B/F	2M x 40 (fast-page)	60 to 100 ns	SIMM
MC424000A8AA/BA/FA	4M x 8 (fast-page); 0.8" high	60 to 100 ns	SIMM
A9AA/BA/FA	4M x 9 (fast-page); 0.8" high	60 to 100 ns	SIMM
MC424100A8A/B	4M x 8 (fast-page)	70, 80 ns	SIMM
A9A/B	4M x 9 (fast-page)	70, 80 ns	SIMM

DRAM MODULES (cont)

Device Number	Organization	Access Times	Packages
(Contact NEC sales)	16M x 8 (fast-page)	70, 80 ns	SIMM
	16M x 9 (fast-page)	70, 80 ns	SIMM
	4M x 32 (fast-page)	70, 80 ns	SIMM
	4M x 36 (fast-page)	70, 80 ns	SIMM
	8M x 32 (fast-page)	70, 80 ns	SIMM
	8M x 36 (fast-page)	70, 80 ns	SIMM

DRAMS

Device Number	Organization	Access Times	Packages
256K/1M DRAMS			
µPD41256	256K x 1 (page)	80 to 100 ns	PLCC
464	64K x 4 (page)	80 to 100 ns	DIP, PLCC
µPD421000	1M x 1 (fast-page)	60 to 100 ns	DIP, SOJ, ZIP
1660	64K x 16 (static-column/byte write)	80 to 100 ns	SOJ
1661	64K x 16 (static-column/WPB)	80 to 100 ns	SOJ
1664	64K x 16 (FP/byte write)	80 to 100 ns	SOJ
1665	64K x 16 (FP/WPB)	80 to 100 ns	SOJ
4256	256K x 4 (fast-page)	60 to 100 ns	DIP, SOJ, ZIP
4268	256K x 4 (static WPB)	60 to 100 ns	DIP, SOJ, ZIP
4M DRAMS			
µPD424100	4M x 1 (fast-page)	60 to 80 ns	SOJ, ZIP, TSOP
101	4M x 1 (nibble)	60 to 80 ns	SOJ, ZIP, TSOP
102	4M x 1 (static-column)	60 to 80 ns	SOJ, ZIP, TSOP
16x/17x 26x/27x	256K x 16 (various)	70 to 100 ns	SOJ, ZIP, TSOP
18x/19x 28x/29x	256K x 18 (various)	70 to 100 ns	SOJ, ZIP, TSOP
µPD424400	1M x 4 (fast-page)	60 to 80 ns	SOJ, ZIP, TSOP
402	1M x 4 (static-column)	60 to 80 ns	SOJ, ZIP, TSOP
410	1M x 4 (fast-page WPB)	60 to 80 ns	SOJ, ZIP, TSOP
412	1M x 4 (static-column WPB)	60 to 80 ns	SOJ, ZIP, TSOP
800	512K x 8 (fast-page)	70 to 100 ns	SOJ, ZIP, TSOP
8xx	512K x 8 (various other)	70 to 100 ns	SOJ, ZIP, TSOP
900	512K x 9 (fast-page)	70 to 100 ns	SOJ, ZIP, TSOP
9xx	512K x 9 (various other)	70 to 100 ns	SOJ, ZIP, TSOP
16M DRAMS			
µPD4216100	16M x 1 (fast-page; 4K refresh)	60 to 80 ns	SOJ, ZIP, TSOP
101	16M x 1 (nibble; 4K refresh)	60 to 80 ns	SOJ, ZIP, TSOP
102	16M x 1 (static-column; 4K refresh)	60 to 80 ns	SOJ, ZIP, TSOP
400	4M x 4 (fast-page; 4K refresh)	60 to 80 ns	SOJ, ZIP, TSOP
402	4M x 4 (static-column; 4K refresh)	60 to 80 ns	SOJ, ZIP, TSOP
410	4M x 4 (fast-page WPB; 4K refresh)	60 to 80 ns	SOJ, ZIP, TSOP
412	4M x 4 (static-column WPB; 4K refresh)	60 to 80 ns	SOJ, ZIP, TSOP
µPD4217100	16M x 1 (fast-page; 2K refresh)	60 to 80 ns	SOJ, ZIP, TSOP
101	16M x 1 (nibble; 2K refresh)	60 to 80 ns	SOJ, ZIP, TSOP
102	16M x 1 (static-column; 2K refresh)	60 to 80 ns	SOJ, ZIP, TSOP
400	4M x 4 (fast-page; 2K refresh)	60 to 80 ns	SOJ, ZIP, TSOP
402	4M x 4 (static-column; 2K refresh)	60 to 80 ns	SOJ, ZIP, TSOP
410	4M x 4 (fast-page WPB; 2K refresh)	60 to 80 ns	SOJ, ZIP, TSOP
412	4M x 4 (static-column WPB; 2K refresh)	60 to 80 ns	SOJ, ZIP, TSOP

SRAMS

16K SRAMs			
µPD4311	16K x 1	35 to 55 ns	DIP
14	4K x 4	35 to 55 ns	DIP
64K SRAMs			
µPD4361	64K x 1	45 to 70 ns	DIP
61B	64K x 1	12 to 20 ns	DIP, SOJ
62	16K x 4	45 to 70 ns	DIP
62B	16K x 4	12 to 20 ns	DIP, SOJ
63B	16K x 4	12 to 20 ns	DIP, SOJ
64	8K x 8	100 to 200 ns	DIP, SOP
68	8K x 8	12 to 20 ns	DIP, SOJ
69	8K x 9	15, 20 ns	DIP, SOJ

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NEC Electronics Inc., *401 Ellis St., Mountain View, CA 94043*
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SRAMS

Device Number	Organization	Access Times	Packages
256K SRAMs			
251	256K x 1	35 to 55 ns	DIP, SOJ
251B	256K x 1	15 to 25 ns	DIP, SOJ
253B	64K x 4	15 to 25 ns	DIP, SOJ
254B	64K x 4	15 to 25 ns	DIP, SOJ
256A	32K x 8	85 to 150 ns	DIP, SOP
256B	32K x 8	55 to 85 ns	DIP, SOP, TSOP
258	32K x 8	35 to 45 ns	DIP, SOJ
258A	32K x 8	15 to 25 ns	DIP, SOJ
259A	32K x 9	15 to 25 ns	DIP, SOJ
µPD46251	256K x 1	20 to 25 ns	DIP
1M SRAMs			
µPD431000	128K x 8	85 to 120 ns	DIP, SOP
1000A	128K x 8	70 to 100 ns	DIP, SOP, TSOP
1001	1M x 1	20 to 35 ns	SOJ
1004	256K x 4	20 to 35 ns	SOJ
4M SRAMs			
µPD434000	512K x 8	55 to 100 ns	DIP, SOP, TSOP
Cache DRAMs			
µPD46710	16K x 10 x 2	15 to 20 ns	PLCC
741	8K x 20 x 2	15 to 20 ns	PLCC
ECL RAMs			
µPB100422	256 x 4 (100K Interface)	7 to 10 ns	DIP, Flatpack
470	4K x 1 (100K Interface)	10 to 15 ns	DIP
474	1K x 4 (100K Interface)	6 to 15 ns	DIP, Flatpack, LCC
474A	1K x 4 (100K Interface)	5 to 6 ns	DIP, Flatpack
474E	1K x 4 (100K Interface)	3 to 4 ns	DIP, Flatpack
480	16K x 1 (100K Interface)	10 to 15 ns	DIP, Flatpack
484	4K x 4 (100K Interface)	10 to 15 ns	DIP, Flatpack
484A	4K x 4 (100K Interface)	5 to 7 ns	DIP, Flatpack, LCC
A484	4K x 4 (100K Interface)	5 to 7 ns	DIP, Flatpack
µPD100500	256K x 1(100K Interface)	15 to 20 ns	DIP
504	64K x 4 (100K Interface)	15 ns	DIP
µPB10422	256 x 4 (10K Interface)	7 to 10 ns	DIP
470	4K x 1 (10K Interface)	10 to 15 ns	DIP
474	1K x 4 (10K Interface)	8 to 15 ns	DIP
474A	1K x 4 (10K Interface)	5 to 6 ns	DIP
474E	1K x 4 (10K Interface)	3 to 4 ns	DIP
480	16K x 1 (10K Interface)	10 to 15 ns	DIP, Flatpack
484	4K x 4 (10K Interface)	10 to 15 ns	DIP, Flatpack
484A	4K x 4 (10K Interface)	5 to 7 ns	DIP, Flatpack
A484	4K x 4 (10K Interface)	5 to 7 ns	DIP, Flatpack
µPD10500	256K x 1 (10K Interface)	15 to 20 ns	DIP
504	64K x 4 (10K Interface)	15 ns	DIP

EPROMS/EEROMS

Device Number	Organization	Access Times	Packages
64K EPROMs			
µPD27HC65	8K x 8	25 to 45 ns	Ceramic DIP
256K EPROMs			
µPD27C256	32K x 8	150 to 250 ns	Ceramic DIP
256A	32K x 8	120 to 200 ns	Ceramic DIP
1M EPROMs			
µPD27C1000A	128K x 8 (ROM Pinout)	120 to 200 ns	Ceramic DIP
1001A	128K x 8 (JEDEC)	120 to 200 ns	Ceramic DIP
1024	64K x 16	150 to 250 ns	Ceramic DIP
1024A	64K x 16 (JEDEC)	120 to 200 ns	Ceramic DIP
2M EPROMs			
µPD27C2001	256K x 8 (JEDEC)	150 to 200 ns	Ceramic DIP
4M EPROMs			
µPD27C4000	256K x 16 or 512K x 8	150 to 200 ns	Ceramic DIP
4001	512K x 8	150 to 200 ns	Ceramic DIP
4096	256K x 16	120 to 200 ns	Ceramic DIP
8M EPROMs			
µPD27C8000	512K x 16 or 1M x 8	120 to 170 ns	Ceramic DIP
8001	1M x 8 (JEDEC)	120 to 170 ns	Ceramic DIP
EEROMs			
µPD28C04	512K x 8	200 to 250 ns	DIP, Miniflat
05	512K x 8	200 to 250 ns	DIP, Miniflat
64	8K x 8	200 to 250 ns	DIP, TSOP
256	32K x 8	200 to 250 ns	DIP, TSOP

ROMS

1M ROMs			
µPD23C1000A	128K x 8	200 ns	DIP, SOP
1000B	128K x 8	150 ns	DIP
1000EA	128K x 8	200 ns	DIP
1001E	128K x 8	200 ns	DIP, SOP, TSOP
1001EA	128K x 8 (JEDEC)	150 ns	DIP, SOP, TSOP
1010A	128K x 8	200 ns	DIP
1024E	64K x 16 (JEDEC)	200 ns	DIP
2M ROMs			
µPD23C2000	128K x 16/256K x 8	250 ns	DIP, SOP
2000A	128K x 16/256K x 8	175/200 ns	DIP
2001	256K x 8 (JEDEC)	250 ns	DIP, SOP, TSOP
2001E	256K x 8 (JEDEC)	200 ns	DIP, SOP
4M ROMs			
µPD23C4000B	256K x 16/512K x 8	200 ns	DIP, QFP
4000J	256K x 16/512K x 8	150 ns	DIP
4001E	512K x 8 (JEDEC)	250 ns	DIP, SOP, TSOP
4001EA	512K x 8 (JEDEC)	200 ns	DIP, SOP
4001EB	512K x 8 (JEDEC)	150 ns	DIP, SOP
µPD23HC4000	512K x 8/256K x 16	100 ns	DIP
4001E	512K x 8 (JEDEC)	100 ns	DIP, SOP
4096E	256K x 16 (JEDEC)	85 ns	DIP
8M ROMs			
µPD23C8000	512K x 16 or 1M x 8	200 ns	DIP, QFP, SOP
8000A	512K x 16 or 1M x 8	200 ns	TSOP, SOP
8000B	512K x 16 or 1M x 8	150 ns	DIP, SOP
8001E	1M x 8 (JEDEC)	200 ns	DIP, SOP
8001EA	1M x 8 (JEDEC)	150 ns	DIP, SOP
16M ROMs			
µPD23C16000	1M x 16 or 2M x 8	250 ns	DIP
		150 ns	DIP, SOP
32M ROMs			
µPD23C32000	4M x 8 or 2M x 16	200 ns	DIP

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Product Line Card — Short Form

VMEbus Interface Chips

- CA91C014 ACC
- CA91C015 DARF32
- CA91C064 DARF64

The CA91C014 ACC together with the CA91C015 DARF32 or CA91C064 DARF64 provides the ultimate in scalable VMEbus interface technology. For VME16/32, full VME32 or the newest, most advanced VME64 applications, these devices offer powerful and flexible VME interface solutions. The VME32 chipset offers a pin-compatible upward migration path to the VME64 chipset, which implements the full VME interface specified by IEEE 1014 Rev D.

The VME64 chipset provides performance up to 70 Mbytes/sec, full multiprocessor VME and 68020/030/040 local bus support and local bus burst transfers.

VMEbus to T1 Link Communication Cards

- VMET1-100
- VMET1-105C
- VMET1-115

VMET1 family brings T1, Fractional T1 and Switched 384 to VME systems. Connecting directly to North American digital T1 networks allows access to all DSØ based (64 kbit/sec channel) T1 network services. Data can be routed to and from T1, VMEbus and TDMbus. HDLC, CSU and DSX-1 hardware module options add HDLC protocol support and allow the VMET1 boards to be configured for central office or customer premise locations.

Futurebus+ Interface Chips

- CA91C896 Distributed Arbiter
- CA91C899 Compelled Interface
- CA91C880 MC88000 Interface

The CA91C899 offers all control functions needed to interface a card to Futurebus+. It includes address & data path, control & status registers and split transaction logic.

The CA91C896 is intended for arbitrated messaging or distributed arbitration applications, while the CA91C880 provides both arbiter and interface functions, optimized for Motorola 88000 RISC.

CMOS Microprocessor and Peripheral Circuits

- CA80C85B 8-bit Microprocessor
- CA53C80 SCSI Controller
- CA82C37A DMA Controller
- CA82C52 Serial Controller
- CA82C54 Prog Interval Timer
- CA82C55A Peripheral Interface
- CA82C59A Interrupt Controller
- CA82C84A Clock Generator/ Driver
- CA82C88 Bus Controller

The CMOS 8000 series peripherals are pin and function compatible with industry standard counterparts. They offer fast (8 - 10 MHz), low power operation and are available in PDIP and PLCC packages and commercial (0 to +70°C) and industrial (–40 to +85°C) temperature ratings.

Audio Processing Products

- CA16C440 BBC AESIC AES/ EBU Interface Transceiver
- AES-001D Evaluation Board
- CA16C001 Digital Audio Companding Processor

The CA16C440 BBC AESIC transceiver implements complete AES/EBU interface standard defined by ANSI S4.40. Variable sample rate selection from 32 to 54 KHz, error detection and channel status info. AES-001D evaluation board provides access to CA16C440 signals and control bits via pin headers and DIP switches.

CA16C001 features single pass compression/ expansion on 16-bit audio data sampled at rates up to 50 KHz. *No loss* Unity™ mode compresses up to 2:1. Hicom™ modes give psycho-acoustically lossless compression up to 4:1, with selectable compression rates up to 30:1.

Data Security Products

- CA20C03A DES Encryption Processor
- CA34C168 Key Management Processor
- RBG 1210 Random Bit Generator

The CA20C03A DES processor encrypts and decrypts data at rates of up to 3.85 Mbytes/sec in accordance with the DES standard specified in DOC publication FIPS PUB 46 (1-15-77). It is *NIST certified* and 8x faster than the industry standard WD20C03A, with which it is fully pin and function compatible.

The CA34C168 Key Management processor is used to implement fully functional Public Key security systems to protect sensitive data in the commercial sector. It provides electronic key management, message authentication and digital signature in DES, public key or hybrid crypto systems. The CA34C168 is compliant with the ANSI X9.17 standard defining public key passing in a DES environment.

The RBG 1210 generates truly random bit streams which can be used to create secure encryption keys or provide random numbers for lottery, gaming and accounting applications.

ESM Programmable Window Filter

- CA29C632A ESM Window Addressable Memory

High speed associative processor compares up to 32-bit input words against 32 programmable sets of upper and lower limits. Applications include electronic warfare signal processing, fuzzy memory and pattern recognition.

CALMOS
Calmos Product Line

NEWBRIDGE MICROSYSTEMS

Newbridge Microsystems

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NEWBRIDGE MICROSYSTEMS
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BIPOLAR LINEAR INTEGRATED CIRCUITS

Operational Amplifiers

Part Number	Main Feature	Circuits /Unit	Operating Voltage	Supply Current	Output Current	Unity Gain Frequency	Package
Single Supply							
NJM2904 *	General Purpose	2	3 to 32V	0.7mA	20mA	0.8MHz	D, L, M, E8, S9
NJM3404A *	Low Distortion	2	to 36V	2.0mA	20mA	1.2MHz	D, L, M, E8, S9
NJM3415 *	High Output Current	2	to 15V	5.5mA	110mA	1.3MHz	D, L, M, E8, S9
NJM3403A *	Low Distortion	4	to 36V	3.0mA	20mA	1.2MHz	D, M14
Dual Supply							
NJM318 *	High Speed	1	to ±20V	5.0mA	20mA	15MHz	D, T, M, E8
NJM4250 *	Low Supply Current	1	±1 to ±18V	Variable	Variable	Variable	D, M, E8
NJM5534 *	Low Noise	1	to ±22V	4.0mA	50mA	10MHz	D, M8
NJM4558 *	General Purpose	2	to ±18V	3.5mA	12mA	2MHz	D, L, T, M, E8, S9
NJM022B *	Low Supply Current	2	±2 to ±18V	250μA	10mA	—	D, L, M, E8
NJM4560 *	Low Noise	2	to ±18V	3.5mA	25mA	10MHz	D, L, T, M, E8, S9
NJM2041 *	Low Noise	2	to ±22V	6.0mA	25mA	7MHz	D, L, M, E8, S9
NJM062 *	J-FET Input	2	to ±18V	400μA	12mA	1MHz	D, L, M, E8, S9
NJM072B *	J-FET Input	2	to ±18V	3.0mA	25mA	3MHz	D, L, M, E8, S9
NJM353 *	J-FET Input	2	to ±18V	3.6mA	16mA	4MHz	D, T, M8
NJM2082 *	J-FET Input	2	to ±18V	4.0mA	40mA	5MHz	D, L, M8, S9
NJM2068 *	Low Noise	2	to ±18V	5.0mA	50mA	5.5MHz	D, L, M, E8, S9
NJM5532 *	Low Noise	2	to ±22V	9.0mA	50mA	10MHz	D, M8, S9
NJM4556 *	High Output Current	2	to ±18V	9.0mA	70mA	8MHz	D, L, M, E8, S9
NJM2058 *	General Purpose	4	to ±18V	3.5mA	12mA	2MHz	D, M14
NJM2060 *	Low Noise	4	to ±18V	3.5mA	25mA	10MHz	D, M14
NJM064 *	J-FET Input	4	to ±18V	800μA	12mA	1MHz	D, M14
NJM074 *	J-FET Input	4	to ±18V	6.0mA	25mA	3MHz	D, M14

Audio and Video ICs

Part No.	Description	Application Examples	Package
NJM386 *	Low Voltage Power Amplifier	AM/FM Radios, Portable Tape Player	D, L, M, E, S9
NJM2067 *	Dual Pre-amplifier	Head Phone Stereos	D, M14
NJM2073 *	Dual Power Amplifier	AM/FM Radios, Portable Tape Player	D, M8, S9
NJM592 *	Differential Video Amplifier	VCR, Audio Equipment	D, M14
NJM2219 *	RF Modulator	VCR	D16
NJM2228 *	Frequency Doubler/Tripler	VCR	D, M8, S9
NJM2234 *	3-input 1-output Video Switch	VCR, Audio Equipment	D, M8, S9
NJM2244 *	Video Switch with 75Ω Driver	VCR, Audio Equipment	D, M8, S9

NJR

OPTO DEVICES

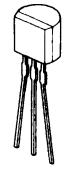
Photo Couplers

Part Number	Couplers /Unit	Isolation Voltage	Emitter		Detector		Package
			Forward Current	Reverse Voltage	C-E Voltage	Collector Current	
NJL5151 **	1	4000V	to 70mA	6V	35V	50mA	D, M4
NJL5152 **	2	4000V	to 50mA	6V	35V	50mA	D, M8
NJL5153 **	3	4000V	to 50mA	6V	35V	50mA	D, M12

Package Outlines

Package Table

TYPE	SYMBOL
TO-92	—
TO-220	—
SOT-89	U
TO-220F	F
DIP	D
DMP	M
EMP	E
SIP	S
ZIP	S
FSIP	S
HDIP	K
SDIP/SIP	L
QFP	F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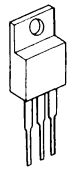
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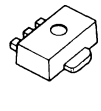
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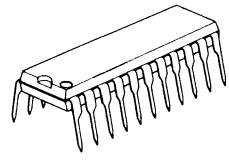
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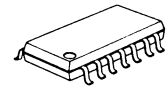
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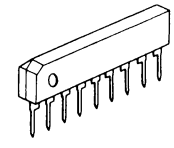
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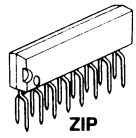
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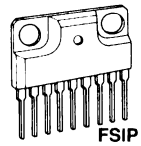
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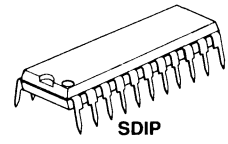
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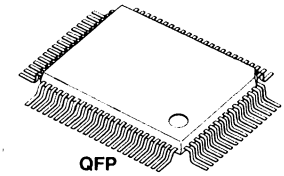
QFP

* SMT packages are available (M-packages are Japanese standard size packages, and E-packages are U.S. standard). ** Packages are (not standard).

JRC New Japan Radio Co.,Ltd. US Subsidiary: NJR Corporation

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C-MOS LINEAR / DIGITAL INTEGRATED CIRCUITS

Voltage Regulators

Part Number	Output Voltage	Maximum Input Voltage	Output Current	Line Regulation	Package (see previous page)
NJU7201 *	+1.2, 1.5, 2.5, 2.7, 3.0, 3.2 +3.5, 4.0, 4.5, 5.0, 5.2, 5.5	+14V	100 mA	0.1%V	L, U
NJU7211 *	-3.0, -5.0V	-18V	100 mA	0.1%V	L, U

Voltage Converters

Part Number	Operating Voltage	Voltage Conv. Rate	Int. Osc.	External Components	Package (see previous page)
NJU7660 *	+1.5V ÷ +10.0V	99.9% (Neg.)	5 KHZ	2 Caps (Neg.) 2 Caps, 2 Res, 1Diode (pos.)	D, M
NJU7662 *	+4.5 ÷ +20.0V	99.9% (Neg.)	10 KHZ	2 Caps (Neg.) 2 Caps, 2 Res, 1 Diode (pos.)	D, M

Operational Amplifiers

Part Number	Main Feature	Circuits /Unit	Operating Voltage	Supply Current	Input Current	Band Width	Package (see previous page)
NJU7001 *	Low Supply Current	1	1 to 18V	15μA	1pA	0.1MHz	D, M8
NJU7002 *	Low Supply Current	2	1 to 18V	30μA	1pA	0.1MHz	D, M8
NJU7004 *	Low Supply Current	4	1 to 18V	60μA	1pA	0.1MHz	D, M14

Quartz Crystal Oscillators

Part Number	Operating Voltage	Operating Current	Stand-by Current	Fanout Ability	Frequency	Package (see previous page)
NJU6323 *	3 to 6V	10mA	100μA	10LSTTL	to 50MHz	E8, Chip
NJU6331 *	4 to 6V	15mA	100μA	5TTL	20 to 75MHz	E8, Chip
NJU6332 *	4 to 6V	15mA	100μA	10LSTTL	20 to 75MHz	E8, Chip
MJU6341 *	4 to 6V	25mA	100μA	5TTL	to 120MHz	E8, Chip

LCD Controller/Drivers

Part Number	Description	Maximum Shift Clock	Package (see previous page)
NJU6408 *	Dot Matrix LCD Controller Driver	—	F80
NJU6407 *	Dot Matrix LCD 40-out Segment Driver	6MHz	F56
NJU6417 *	Dot Matrix LCD 64-out Segment Driver	6MHz	F80
NJU6405 *	Dot Matrix LCD Serial-in 86-out Row Driver	6MHz	F100
NJU6404 *	Dot Matrix LCD 4-bit Bus 80-out Column Driver	6MHz	F100

Analog Switches

Part Number	Feature and Description	Circuits /Unit	Analog Signal Range	Break Down Voltage	On-state Resistance	Package (see previous page)
NJU201A *	Low On-state Resistance	4	±15V	44V	50Ω	D, M16
NJU211 *	General Purpose	4	±15V	40V	115Ω	D, M16
NJU7301 *	General Purpose	4	±15V	44V	115Ω	D, M16
NJU7304	8-channel Multiplexer	1	0 to 10V	20V	—	D16

RS232C Interface Line Drivers/Receivers

Part Number	Configuration	Supply Voltage	Compatibility	Noise Filter	Package (see previous page)
NJU6401B *	3 Drivers/5 Receivers	+5V/±12V	TTL	Yes	D, M
NJU6402B *	3 Drivers/5 Receivers	+5V/±12V	TTL	Yes	D, M
NJU6403A *	2 Drivers/2 Receivers	+5V Single	TTL	Yes	D
NJU6410A *	3 Drivers/3 Receivers	+5V Single	TTL	Yes	D, M
NJU6413A *	2 Drivers/2 Receivers	+5V Single	TTL	Yes	D, M

*SMT packages are available (M-packages are Japanese standard size packages, and E-packages are U.S. standard).

NJR

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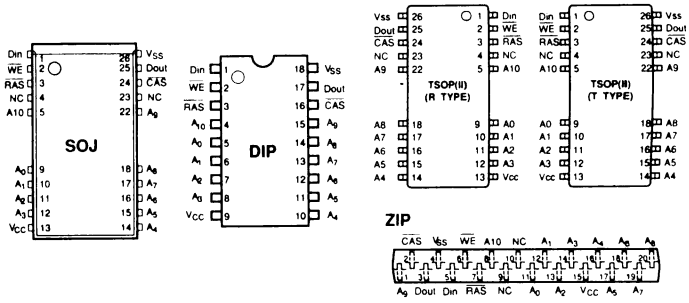
NMB TECHNOLOGIES, INC.
HIGH SPEED DRAMs

AAA4M200 Fast Page Mode — CMOS 4M×1 Dynamic RAM
AAA4M204 Fast Page Mode — CMOS 1M×4 Dynamic RAM

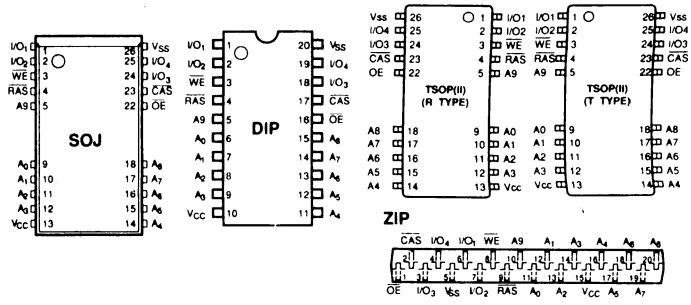
FEATURES

- Industry Standard Pinouts
- 40, 45, 50, 60, or 80ns RAS Access Time (t_{RAC})
- Enhanced Page Mode
- RAS-Only Refresh, Hidden Refresh and CAS-before-RAS Refresh
- Battery Backup Mode with Automatic Refresh (optional)
- Test Mode
- Commercial Voltage/Temperature Range
  4.5 - 5.5 Volts Vcc
  0 - 70°C Operating Temperature
- Packages - 20 Pin 300mil PDIP (P)
  26 Pin SOJ (J)
  20 Pin ZIP (Z)
  26 Pin TSOP II (R, T)

AAA4M200 SERIES - 4M×1



AAA4M204 SERIES - 1M×4



AAA4M200 SERIES

Part Number	tRAC	tCAC	tAA (tCAA)	tRC	tPC	Icc (Standby)	Icc (Battery Backup)	Icc (Active)	Refresh (t_{REF})
4M×1 - ENHANCED PAGE MODE									
AAA4M200X-04	40ns	15ns	25ns	80ns	35ns	1mA	300μA	130mA	16ms
AAA4M200X-45	45ns	15ns	25ns	80ns	35ns	1mA	300μA	130mA	16ms
AAA4M200X-05	50ns	15ns	27ns	100ns	37ns	1mA	300μA	120mA	16ms
AAA4M200X-06	60ns	15ns	30ns	110ns	40ns	1mA	300μA	110mA	16ms
AAA4M200X-08	80ns	20ns	40ns	150ns	50ns	1mA	300μA	80mA	16ms
1M×4 - ENHANCED PAGE MODE									
AAA4M204X-04	40ns	15ns	25ns	80ns	35ns	1mA	300μA	130mA	16ms
AAA4M204X-45	45ns	15ns	25ns	80ns	35ns	1mA	300μA	130mA	16ms
AAA4M204X-05	50ns	15ns	27ns	100ns	37ns	1mA	300μA	120mA	16ms
AAA4M204X-06	60ns	15ns	30ns	110ns	40ns	1mA	300μA	110mA	16ms
AAA4M204X-08	80ns	20ns	40ns	150ns	50ns	1mA	300μA	80mA	16ms

NOTE: (X) Indicates package type

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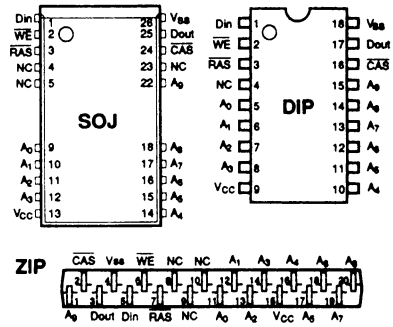
NMB TECHNOLOGIES, INC.
HIGH SPEED DRAMs

AAA1M300 Fast Page Mode — CMOS 1M×1 Dynamic RAM
AAA1M304 Fast Page Mode — CMOS 256K×4 Dynamic RAM

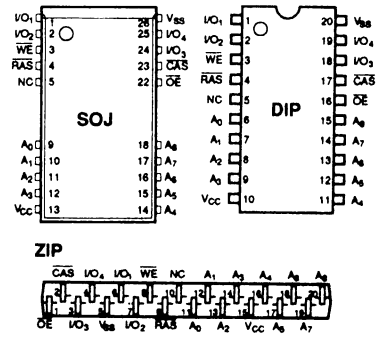
FEATURES

- Industry Standard Pinouts
- 53, 60, 70 or 80ns RAS Access Time (t_{RAC})
- Enhanced Page Mode
- RAS-Only Refresh, Hidden Refresh and CAS-before-RAS Refresh
- Commercial Voltage/Temperature Range
  - 4.5 - 5.5 Volts Vcc
  - 0 - 70°C Operating Temperature
- Packages - 18/20 Pin 300mil PDIP (P)
  - 26 Pin SOJ (J)
  - 20 Pin ZIP (Z)
- Slow Refresh Available

AAA1M300 SERIES - 1M×1



AAA1M304 SERIES - 256K×4



AAA1M300 SERIES

Part Number	t_{RAC}	t_{CAC}	t_{AA} (t_{CAA})	t_{RC}	t_{PC}	I_{CC} (Standby)	I_{CC} (Active)	Refresh Period
1M×1 - ENHANCED PAGE MODE								
AAA1M300X-53	53ns	15ns	26ns	100ns	30ns	1mA	80mA	8ms
AAA1M300X-06	60ns	15ns	30ns	110ns	35ns	1mA	80mA	8ms
AAA1M300X-07	70ns	20ns	35ns	130ns	40ns	1mA	70mA	8ms
AAA1M300X-08	80ns	20ns	40ns	150ns	45ns	1mA	60mA	8ms
256K×4 - ENHANCED PAGE MODE								
AAA1M304X-53	53ns	15ns	26ns	100ns	30ns	1mA	80mA	8ms
AAA1M304X-06	60ns	15ns	30ns	110ns	35ns	1mA	80mA	8ms
AAA1M304X-07	70ns	20ns	35ns	130ns	40ns	1mA	70mA	8ms
AAA1M304X-08	80ns	20ns	40ns	150ns	45ns	1mA	60mA	8ms

NOTE: (X) Indicates package type

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Dynamic RAMs

PART NUMBER	PACKAGE	DESCRIPTION
Memory Modules With/Without Pins (CMOS)		
MSC2312A-XXZZ9-B	30-pin	1 Meg x 9 DRAM module, single side
MSC2313A-XXZZ8-B	30-pin	1 Meg x 8 DRAM module, single side
MSC2320A-XXYS9-8	72-pin	256K x 36 DRAM module, double side
MSC2321A-XXYS18-B	72-pin	512K x 36 DRAM module, double side
MSC2331A-XXZZ3-B	30-pin	256K x 9 DRAM module, single side
MSC2340-XXZZ9	30-pin	4 Meg x 9 DRAM module, single side
MSC2341-XXZZ8	30-pin	4 Meg x 8 DRAM module, single side
MSC2322-XXZZ20	72-pin	512K x 40 DRAM module, double side
MSC2333-XXZZ16	72-pin	512K x 32 DRAM module, double side
MSC2352A-XXZZ20	72-pin	2 Meg x 40 DRAM module, double side
MSC2353A-XXZZ10	72-pin	1 Meg x 40 DRAM module, double side
MSC2355-XXZZ12	72-pin	1 Meg x 36 DRAM module, double side
MSC2356-XXZZ24	72-pin	2 Meg x 36 DRAM module, double side
MSC2357-XXZZ8	72-pin	1 Meg x 32 DRAM moduel, double side
MSC2358-XXZZ2	30-pin	1 Meg x 8 DRAM module, single line
MSC2359-XXZZ3	30-pin	1 Meg x 9 DRAM module, single side
MSC2360-XXZZ12	72-pin	1 Meg x 36 DRAM module, single side
MSC2361-XXZZ8	72-pin	1 Meg x 32 DRAM module, single side
MSC2362-XXZZ16	72-pin	2 Meg x 32 DRAM module, double side
MSC23109-XXZZ3	30-pin	1 Meg x 9 4 Meg shrink module, single side
MSC23108-XXZZ2	30-pin	1 Meg x 8 4 Meg shrink module, single side
MSC23409-XXZZ9	30-pin	4 Meg x 9 4 Meg shrink module, single side
MSC23408-XXZZ8	30-pin	4 Meg x 8 4 Meg shrink moduel, single side
MSC23123-XXZZ8	72-pin	1 Meg x 32 4 Meg shrink module, single side
MSC23232-XXZZ16	72-pin	2 Meg x 32 4 Meg shrink module, double side
MSC23136-XXZZ12	72-pin	1 Meg x 36 4 Meg shrink module, single side
MSC23236-XXZZ24	72-pin	2 Meg x 36 4 Meg shrink module, double side
MSC23140-XXZZ10	72-pin	1 Meg x 40 4 Meg shrink module, single side
MSC23240-XXZZ20	72-pin	2 Meg x 40 4 Meg shrink moduel, double side
256K Density		
MSM41256A-XXZZ	—	256K x 1 NMOS DRAM CAS-before-RAS
MSM41464-XXZZ	—	64K x 4 NMOS DRAM
MSM51C256-XXZZ	—	256K x 1 CMOS DRAM
MSM51C464-XXZZ	—	64K x 4 CMOS DRAM
1 Meg Density (CMOS)		
MSM511000A-XXZZ-B	—	1 Meg x 1 fast page mode
MSM511001A-XXZZ-B	—	1 Meg x 1 nibble mode
MSM511002A-XXZZ-B	—	1 Meg x 1 static column mode
MSM511000A-XXZZ-B	—	1 Meg x 1 fast page mode
MSM511001A-XXZZ-B	—	1 Meg x 1 nibble mode
MSM511002A-XXZZ-B	—	1 Meg x 1 static column mode
MSM511000B-XXZZ	—	1 Meg x 1 fast page
MSM511001B-XXZZ	—	1 Meg x 1 nibble mode
MSM511002B-XXZZ	—	1 Meg x 1 static column mode
MSM514256A-XXZZ-B	—	256K x 4 fast page mode
MSM514258A-XXZZ-B	—	256K x 4 static column mode
MSM514256B-XXZZ	—	256K x 4 fast page mode
MSM514258B-XXZZ	—	256K x 4 static column mode
MSM514266B-XXZZ	—	256K x 4 fast page write per bit mode
MSM514268B-XXZZ	—	256K x 4 static column write per bit mode
4 Meg Density (CMOS)		
MSM514100-XXZZ	—	4 Meg x 1 fast page mode
MSM514101-XXZZ	—	4 Meg x 1 nibble mode
MSM514102-XXZZ	—	4 Meg x 1 static column mode
MSM514100A-XXZZ	—	4 Meg x 1 shrink fast page mode
MSM514101A-XXZZ	—	4 Meg x 1 shrink nibble mode
MSM514102A-XXZZ	—	4 Meg x 1 shrink static column mode
MSM514400-XXZZ	—	1 Meg x 4 fast page mode
MSM514402-XXZZ	—	1 Meg x 4 static column mode
MSM514400A-XXZZ	—	1 Meg x 4 shrink fast page mode
MSM514402A-XXZZ	—	1 Meg x 4 shrink static column mode
MSM514410A-XXZZ	—	1 Meg x 4 write per bit mode
MSM514412A-XXZZ	—	1 Meg x 4 static column per bit mode

XX=Speed
60=60 ns tRAC/15 ns tCAC
80=80 ns tRAC/20 ns tCAC
70=70 ns tRAC/20 ns tCAC
8A = 80 ns tRAC/25 ns tCAC

ZZ=Package
YS=Module without pins
KS=Module with pins
DS=Gold pad
BS=Gold pad

XX=Speed
10=100 ns tRAC/25 ns tCAC
80=80 ns tRAC/20 ns tCAC
70=70 ns tRAC/20 ns tCAC

ZZ=Package
RS=16-pin DIP
JS=18-pin PLCC
ZS=20-pin ZIP

XX=Speed
60=60 ns tRAC/15 ns tCAC
80=80 ns tRAC/20 ns tCAC
70=70 ns tRAC/20 ns tCAC

ZZ=Package
RS=20-pin DIP: 300 mil
JS=26-pin SOJ: 300 mil
ZS=20-pin ZIP

XX=Speed
80=80 ns tRAC/20 ns tCAC
70=70 ns tRAC/20 ns tCAC

ZZ=Package
RS=20-pin DIP
JS=26-pin SOJ: 350 mil
SJ=26-PIN SOJ: 300 mill
ZS=20-pin ZIP
TS-K/TS-L=24-pin TSOP

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Application Specific RAMs (CMOS)

PART NUMBER	PACKAGE	DESCRIPTION
MSM514221A-3RS	16-pin DIP	256K x 4 field memory
MSM514221A-4RS	16-pin DIP	256K x 4 field memory
MSM514221A-6RS	16-pin DIP	256K x 4 field memory
MSM514221A-3JS	26-pin SOJ	256K x 4 field memory
MSM514221A-4JS	26-pinSOJ	256K x 4 field memory
MSM514221A-6JS	26-pinSOJ	256K x 4 field memory
MSM514221A-3ZS	20-pin ZIP	256K x 4 field memory
MSM514221A-4ZS	20-pinZIP	256K x 4 field memory
MSM514221A-6ZS	20-pinZIP	256K x 4 field memory
MSM514252-10ZS	28-pin ZIP	256K x 4 VRAM
MSM514252-12ZS	28-pin ZIP	256K x 4 VRAM
MSM514252-10JS	40-pin SOJ	256K x 4 VRAM
MSM51C262-10ZS	24-pin ZIP	64K x 4VRAM
MSM548128-10RS	32-pin DIP	128K x 8 pseudo SRAM
MSM548512-10RS	32-pin DIP	512K x 8 pseudo SRAM
MSM548128-80GS-K	32-pin SOP	128K x 8 pseudo SRAM
MSM548512-80GS-K	32-pin SOP	512K x 98pseudo SRAM

Speeds	
3=30 ns	80=80 ns
4=40 ns	10=100 ns
6=60 ns	12=120 ns

SRAMs

PART NUMBER	PACKAGE	DESCRIPTION
MSM5165AL-XXZZ	28-pin	8K x 8 MixMOS Static RAM
MSM51257ALL-XXZZ	28-pin	32K x 8 MixMOS Static RAM
MSM521001-XXZZ	32-pin	128K x 8 CMOS Static RAM

XX=Speed	ZZ=Package
10=100 ns	RS=DIP
12=120 ns	GS-K=SOP
85=85 ns	
70=70 ns	

EEPROMs/EPROMs/FLASH (CMOS)

PART NUMBER	PACKAGE	DESCRIPTION
MSM16811RS	8-pin DIP	1K x 1 EEPROM
MSM16811MS-K	8-pin SOP	1K x 1 EEPROM
MSM16911RS	8-pin DIP	1K x 1 EEPROM
MSM16812RS	8-pin DIP	2K x 1 EEPROM
MSM16812MS-K	8-pin SOP	2K x 1 EEPROM
MSM16912RS	8-pin DIP	2K x 1 EEPROM
MSM16912MS-K	8-pin SOP	2K x 1 EEPROM
MSM16911MS-K	8-pin SOP	1K x 1 EEPROM
MSM27C256H-55RS	28-pin DIP	32K x 8 fast ERPM, 55 ns
MSM27C256H-70RS	28-pin DIP	32K x 8 fast EPROM, 70 ns
MSM28C16A-15RS	24-pin DIP	2K x 8 EEPROM, 150 ns
MSM28C16A-20RS	24-pin DIP	2K x 8 EEPROM, 200 ns
MSM28C64A-12RS	28-pin DIP	8K x 8 EEPROM, 120 ns
MSM28C64A-15RS	28-pin DIP	8K x 8 EEPROM, 150 ns
MSM28C64A-20RS	28-pin DIP	8K x 8 EEPROM, 200 ns
MSM28C256RS	28-pin DIP	32K x 8 EEPROM
MSM28F010RS	32-pin DIP	128K x 8 Flash
MSM27C2000ZB	32-pin DIP	256K x 8 OTP, 150 ns
MSM27C401ZB	32-pin CerDIP	512K x 8 OTP, 100 ns

ROMs (CMOS)

PART NUMBER	PACKAGE	DESCRIPTION
MSM534000A-15RS	40-pin DIP	256K x 16 ROM
MSM534001A-15RS	32-pin DIP	512K x 8 ROM
MSM534002A-15RS	32-pin DIP	256K x 16 or 512K x 8 ROM
MSM531000ARS	28-pin DIP	1 Meg ROM, 100 ns
MSM531001ARS	32-pin DIP	1 Meg ROM, 100 ns
MSM532001ARS	32-pin DIP	2 Meg ROM, 120 ns
MSM538001BRS	32-pin DIP	8 Meg ROM, 120 ns
MSM538002BRS	42-pin DIP	8 Meg ROM, 150 ns

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Microprocessors (CMOS)

PART NUMBER	PACKAGE	DESCRIPTION
MSM80C85ARS	40-pin DIP	8-bit microprocessor, 3 MHz
MSM80C85A-2RS	40-pin DIP	8-bit microprocessor, 5 MHz
MSM80C85A-2GS-VK	44-pin QFP	8-bit microprocessor, 5 MHz
MSM80C85A-2JS	44-pin POLCC	8-bit microprocessor, 5 MHz
MSM80C86ARS	40-pin DIP	Static 16-bit CPU, 5 MHz
MSM80C86A-2RS	40-pin DIP	Static 16-bit CPU, 8 MHz
MSM80C86A-2JS	44-pin PLCC	Static 16-bit CPU, 8 MHz
MSM80C86A-10RS	40-pin DIP	Static 16-bit CPU, 10 MHz
MSM80C88ARS	40-pin DIP	Static 16-/8-bit CPU, 5 MHz
MSM80C88A-2RS	40-pin DIP	Static 16-/8-bit CPU, 8 MHz
MSM80C88A-2JS	44-pinPLCC	Static 16-8-bit CPU, 8 MHz
MSM80C88A-10RS	40-pin DIP	Static 16-/8-bit CPU, 10 MHz
MSM80C88A-10JS	44-pin PLCC	Static 16-/8-bit CPU, 10\ MHz

Peripherals (CMOS)

PART NUMBER	PACKAGE	DESCRIPTION
MSM5832RS	18-pin DIP	Real-time clock
MSM58321RS	16-pin DIP	REal-time clock
MSM6242BRS	18-pin DIP	Real-time clock, 120 ns
MSM6242BGS-VK	24-pin SOP	Real-time clock, 120 ns
MSM62X42BRS-A	18-pin DIP	Real-time clock, 120 ns with built-in crystal, 10 ppm
MSM62X42BRS-B	18-pin DIP	Real-time clock, 120 ns with built-in crystal, 50 ppm
MSM6252RS	18-pin DIP	64K x 4 FIFO
MSM6253RS	16-pin DIP	8-bit 4-channel A/D converter
MSM6286GS-VK	44-pin QFP	High-speed 4-bit A/D converter
MSM81C55-5GS-VK	44-pin QFP	256 x 8 RAM I/O and timer
MSM81C55-5JS	44-pin PLCC	256 x 8 RAM I/O and timer
MSM82C12RS	24-pin DIP	8-bit I/O port
MSM82C12GS-VK	24-pin SOP	8-bit I/O port
MSM82C37A-5RS	40-pin DIP	Programmable DMA controller
MSM82C37A-5JS	44-pin PLCC	Programmable DMA controller
MSM82C37A-5GS-K	44-pin QFP	Programmable DMA controller
MSM82C51A-2JS	28-pin PLCC	USART, 8 MHz
MSM82C51A-2GS-VK	32-pin SOP	USART, 8 MHz
MSM82C53-2RS	24-pin DIP	Programmable interval timer
MSM82C53-2JS	28-pin PLCC	Programmable interval timer
MSM82C53-2GS-VK	32-pin SOP	Programmable interval timer
MSM82C54-2RS	24-pin DIP	High-performance, programmable interval timer, 10 MHz
MSM82C54-2GS-VK	32-pin SOP	High-performance, programmable interval timer, 10 MHz
MSM82C54-2JS	28-pin PLCC	High-performance, programmable interval timer, 10 MHz
MSM82C55A-2GS-VK	44-pin QFP	Programmable peripheral interface
MSM82C55A-2VJS	44-pin PLCC	Programmable peripheral interface
MSM82C59A-2RS	28-pin DIP	8-bit interrupt controller
MSM82C59A-2GS-VK	32-pin SOP	8-bit interrupt controller
MSM82C59A-2JS	28-pin PLCC	8-bit interrupt controller
MSM82C84A-2JS	20-pin PLCC	16-bit clock generator, 8 MHz
MSM82C84A-2RS	18-pin DIP	16-bit clock generator, 8 MHz
MSM82C88-2RS	20-pin DIP	8-/16-bit bus controller, 8 MHz
MSM82C88-2JS	20--pin PLCC	8-/16-bit bus controller, 8 MHz
MSM82C88-2GS-VK	24-pin SOP	8-/16-bit bus controller, 8 MHz
MSM83C55-XXRS	40-pin DIP	2K x 8 ROM with I/O
MSM83C55-XXGS	44-pin QFP	2K x 8 ROM with I/O
MSM83C55-XXJS	40-pin PLCC	2K x 8 ROM with I/O

4-Bit Microcontrollers

PART NUMBER	PACKAGE	DESCRIPTION
OLMS-40 Series (CMOS)		
MSM5840HRS	42-pin DIP	4-bit microcontroller, ROMless 5840 option
MSM5840H-XXRS	42-pin DIP	4-bit microcontroller, 2K ROM, 128-bit RAM, 16 I/O lines
MSM5840H-XXGS-K	44-pin QFP	4-bit microcontroller, 2K ROM, 128-bit RAM
MSM5842-XXRS	28-pin DIP	4-bit microcontroller, 768 ROM, 32-bit RAM, 8 I/O lines
MSM5842-XXGS-K	32-pin SOP	4-bit microcontroller, 1.5K ROM, 40-bit RAM, 35-segment LCD driver
MSM58422-XXGS-K	60 pin QFP	4-bit microcontroller, 1.5K ROM, 40-bit RAM, 7 x 5 segment VF driver
MSM5847A-XXGS-K	44-pin QFP	4-bit microcontroller, 1.5K ROM, 96-bit RAM, 72-segment LCD driver
Development Tools for OLMS-40 Series		
EASE40	—	Emulator for 5840/42 and 58421/22 microcontroller
MPB421	—	Adapter module for EASE40 for 58421 microcontroller
MPB422	—	Adapter module for EASE40 for 58422 microcontroller

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4-Bit Microcontrollers - (continued)

PART NUMBER	PACKAGE	DESCRIPTION
OLMS-50/60 Low Power Series (CMOS)		
MSM5052-XX	Chip	4-bit microcontroller, 1.2K ROM, 52-segment LCD driver and thermometer
MSM5052-01	Chip	5052 option with built-in clock
MSM5052-01GS-K	56-pin QFP	5052 option with built-in clock
MSM5052-02	Chip	5052 option with built-in clinical thermometer and clock
MSM5052-02GS-K	80-pin QFP	5052 option with built-in clincial thermometer and clock
MSM5052-10	Chip	5052 option with built-in alarm function
MSM5052-10GS-K	80-pin Chip	5052 option with built-in alarm function
MSM5054-XX	Chip	4-bit microcontroller, 1K ROM, 62-bit RAM, 88-segment LCD driver
MSM5055-XX	Chip	4-bit microcontroller, 1.8K ROM, 96-bit RAM, 120-segment LCD driver
MSM5056-XX	Chip	4-bit microcontroller, 1.8K ROM, 76-segment LCD driver, solar operation
MSM5056-01	Chip	5056 option with built-in clock, calendar alarm and calculator
MSM6051-XX	Chip	4-bit microcontroller, 2.5K ROM, 120-bit RAM, 189-segment LCD driver
MSM6351-XXGGS-K	100-pin QFP	4-bit microcontroller, 4K ROM, 1K RAM, 177-segment LCD driver
MSM6351-XXX	Chip	4-bit microcontroller, 4K ROM, 1K RAM, 177-segment LCD driver
MSM6353-XXSS	42-pin SDIP	4-bit microcontroller, 4K ROM, 1K RAM, 20 I/O lines
MSM6052-XXRS	28-/40pin DIP	4-bit microcontroller, phone application, 2K ROM, 640-bit RAM, DTMF
MSM6052-XXGS-K	44-pin QFP	4-bit microcontroller, phone application, 2K ROM, 640-bit RAM, DTMF
MSM6052-01GS-K	44-pin QFP	6052 option with 300ms DP/tone delay
MSM6052-11GS-K	44-pin QFP	6052 option with 33ms DP/tone delay
MSM6052-20GS-K	44-pin QFP	6052 option with 100ms DP/tone delay, repertory dialer
MSM6352-XXRS	28/-40pin DIP	4-bit microcontroller, phone application, 2K ROM, 640-bit RAM, DTMF
MSM6352-GS	44-pin QFP	4-bit microcontroller, phone application, 2K ROM, 640-bit RAM, DTMF
Development Tools for OLMS-50/60 Series		
EASE 5052/56	—	Emulator for 5052/56 microcontrollers
EASE 5054/55	—	Emulator for 5054/55 microcontrollers
EASE 6051	—	Emulator for 6051 microcontroller
EASE 6351/53	—	Emulator for 6351/6363 microcontrollers
EASE 6052	—	Emulator for 6052 microcontroller
EASE 6352	—	Emulator for 6352 microcontroller
EASE 6351	—	Development system for 6351 MCU
EASE 6352	—	Development system for 6352 MCU
OLMS-64 Series (CMOS)		
MSM6404-XXRS	42-pin DIP	4 bit microcontroller, 4K ROM, 256-bit RAM, 36 I/O lines
MSM6404-XXGS-K	44-pin QFP	4-bit microcontroller, 4K ROM, 256-bit RAM, 36 I/O lines
MSM6404VS	28-pin Piggyback	Piggyback IC for 6404 code development
MSM6408-XXRS	42-pin DIP	4-bit microcontroller, 8K ROM, 256-bit RAM, 36 I/O lines
MSM6408-XXGS-K	44-pin QFP	4-bit microcontroller, 8K ROM, 256-bit RAM, 36 I/O lines
MSM6411B-XXRS	16-pin DIP	4-bit microcontroller, 1K ROM, 32-bit RAM, 11 I/O lines
MSM6411B-XXGS-K	24-pin SOP	4-bit microcontroller, 1K ROM, 32-bit RAM, 11 I/O lines
MSM6422-XXRS	24-pin DIP	4-bit microcontroller, 2K ROM, 64-bit RAM, 19 I/O lines
MSM6422-XXGS-K	24-pin QFP	4-bit microcontroller, 2K ROM, 64-bit RAM, 19 I/O lines
MSM6434-XXRS	40-pin DIP	4-bit microcontroller, 4K ROM, 256-bit RAM, 13 I/O, 4-channel/8-bit A/D converter
MSM6434-XXSS	30-pin SDIP	4-bit microcontroller, 4K ROM, 256-bit RAM, 13 I/O, channel/8-bit A/D converter
MSM6442-XXGS-K	80-pin QFP	4-bit microcontroller, 2K ROM, 126-bit RAM, 92-segment LCD driver
MSM6458-VS	28-pin	4-bit microcontroller, 8K ROM, 512-bit RAM, 144-segment VF driver
MSM6458-XXSS	64-pin SDIP	4-bit microcontroller, 8K ROM, 512-bit RAM, 144-segment VF driver
Development Tools for OLMS-64 Series		
EASE 6400	—	Emulator for 64XX/microcontrollers
EASE 6458	—	Emulator for 6458 microcontroller
MSM6404VS	42-pin Piggyback	Piggyback IC for 6404 microcontroller
MSM6458VS	64-pin Piggyback	Piggyback IC for 6458 microcontroller
PAM 6411	—	Adapter module for EASE 6400 for 6411 microcontroller
PAM 6422	—	Adapter module for EASE 6400 for 6422 microcontroller
PAM 6434	—	Adapter module for EASE 6400 for 6434 microcontroller
PAM 6442	—	Adapter module for EASE 6400 for 6442 microcontroller
PEM 6411	—	Field debugging for 6411 microcontroller
PEM 6422	—	Field debugging for 6422 microcontroller
PEM 6434	—	Field debugging for 6434 microcontroller
PEM 6442	—	Field debugging tool for 6442 microcontroller
OLMS-65 Series (CMOS)		
MSM6502B-XXGS-K	56-pin QFP	4-bit microcontroller, 2K ROM, 128-bit RAM, 108-segment LCD driver
MSM6512-XXGS-K	56-pin QFP	4-bit microcontroller, 2K ROM, 128-bit RAM, 104-segment LCD driver
Development Tools for OLMS-65 Series		
EASE6502	—	Emulator for 6502/6512 microcontroller
MPB6502EVA	—	Field debugging tool for 6502/6512 microcontroller

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8-Bit Microcontrollers

PART NUMBER	PACKAGE	DESCRIPTION
Intel Compatible Microcontrollers (CMOS)		
MSM80C35RS	40-pin DIP	8-bit microcontroller, ROMless 80C48 option, 64-bit RAM, 24 I/O
MSM80C35GS-VK	44-pin QFP	8-bit microcontroller, ROMless 80C48 option, 64-bit RAM, 24 I/O
MSM80C39GS-VK	44-pin QFP	8-bit microcontroller, ROMless 80C49 option, 128-bit RAM, 24 I/O
MSM80C40RS	40-pin DIP	8-bit microcontroller, ROMless 80C50 option, 256-bit RAM, 24 I/O
MSM80C40GS-VK	44-pin QFP	8-bit microcontroller, ROMless 80C50 option, 256-bit RAM, 24 I/O
MSM80C48-XXRS	40-pin DIP	8-bit microcontroller, 8048, 1K ROM, 64-bit RAM, 24 I/O
MSM80C48-XXGS-VK	44-pin DIP	8-bit microcontroller, 8048, 1K ROM, 64-bit RAM, 24 I/O
MSM80C49-XXRS	40-pin DIP	8-bit microcontroller, 8049, 2K ROM, 128-bit RAM, 24 I/O
MSM80C49-XXGS-VK	44-pin QFP	8-bit microcontroller, 8049, 2K ROM, 128-bit RAM, 24 I/O
MSM80C50-XXRS	40-pin DIP	8-bit microcontroller, 8050, 4K ROM, 256-bit RAM, 24 I/O
MSM80C50-XXGS-VK	44-pin QFP	8-bit microcontroller, 8050, 4K ROM, 256-bit RAM, 24 I/O
MSM80C31FRS	40-pin DIP	8-bit microcontroller, ROMless 80C51 option, 12 MHz, 128-bit RAM
MSM80C31FRS-1	40-pin DIP	8-bit microcontroller, ROMless 80C51 option, 16 MHz, 128-bit RAM
MSM80C31FJS	44-pin PLCC	8-bit microcontroller, ROMless 80C51 option, 12 MHz, 128-bit RAM
MSM80C31FJS-1	44-pin PLCC	8-bit microcontroller, ROMless 80C51 option, 16 MHz, 128-bit RAM
MSM80C31FVGS-V1K	44-pin QFP	8-bit microcontroller, ROMless 80C51, 12 MHz 128-bit RAM, Intel compatible pinout
MSM80C31FVGS-V1K-1	44-pin QFP	8-bit microcontroller, ROMless 80C51, 16 MHz, 128-bit RAM Intel compatible pinout
MSM80C51F-XXRS	40-pin DIP	8-bit microcontroller, 12 MHz, 4K ROM, 128-bit RAM
MSM80C51FV-XXGS-V1K	40-pin QFP	8-bit microcontroller, 12 MHz, 4K ROM, 128-bit RAM, Intel compatible pinout
MSM80C51F-XXJS	44-pin PLCC	8-bit microcontroller, 12 MHz, 4K ROM, 128-bit RAM
MSM80C51F-XXRS-1	40-pin DIP	8-bit microcontroller, 16 MHz, 4K ROM, 128-bit RAM
MSM80C51FV-XXG-V1K-1	44-pin QFP	8-bit microcontroller, 16 MHz, 4K ROM, 128 bit RAM, Intel compatible pinout
MSM80C51F-XXJS-1	44-pin PLCC	8-bit microcontroller, 16 MHz, 4K ROM, 128-bit RAM
MSM80C154RS	40-pin DIP	8-bit microcontroller, 12 MHz, ROMless option, 256-bit RAM
MSM80C154RS-1	40-pin DIP	8-bit microcontroller, 16 MHz, ROMless option, 256-bit RAM
MSM80C154V-GS-V1K	44-pin QFP	8-bit microcontroller, 12 MHz, ROMless option, 256-bit RAM
MSM80C154V-GS-V1K	44-pin QFP	8-bit microcontroller, 16 MHz, ROMless option, 256-bit RAM
MSM80C154JS	44-pin PLCC	8-bit microcontroller, 12 MHz, ROMless option, 256-bit RAM
MSM80C154JS-1	44-pin PLCC	8-bit microcontroller, 16 MHz, ROMless option, 256-bit RAM
MSM83C154-XXRS	40-pin DIP	8-bit microcontroller, 12 MHz, 16K ROM, 256-bit RAM
MSM83C154V-GSV1K	44-pin QFP	8-bit microcontroller, 12 MHz, 16K ROM, 256-bit RAM
MSM83C154-XXJS	44-pin PLCC	8-bit microcontroller, 12 MHz, 16K ROM, 256-bit RAM
MSM83C154-XXJS	44-pin PLCC	8-bit microcontroller, 12 MHz, 16K ROM, 256-bit RAM
MSM83C154-XXRS-1	40-pin DIP	8-bit microcontroller, 16 MHz, 16K ROM, 256-bit RAM
MSM83C154V-GS-V1K-1	44-pin QFP	8-bit microcontroller, 16 MHz, 16K ROM, 256-bit RAM
MSM83C154-XXJS-1	44-pin PLCC	8-bit microcontroller, 16 MHz, 16K ROM, 256-bit RAM
MSM85C154VS	40-pin Piggyback	Piggyback IC for 80C51 and 83C154 code development, 16 MHz
MSM80C31FVGS-V1K	44-pin QFP	8-bit microcontroller, ROMless 80C51, 12 MHz, 128-bit RAM, Intel compatible pinout
MSM80C31FVGS-V1K-1	44-pin QFP	8-bit microcontroller, ROMless 80C51, 16 MHz, 128-bit RAM, Intel compatible pinout
MSM80C51F-XXRS	40-pin DIP	8-bit microcontroller, 12 MHz, 4K ROM, 128-bit RAM
MSM80C51FV-XXGS-V1K	40-pin QFP	8-bit microcontroller, 12 MHz, 4K ROM, 128-bit RAM, Intel compatible pinout
MSM80C51F-XXJS	44-pin PLCC	8-bit microcontroller, 12 MHz, 4K ROM, 128-bit RAM
MSM80C51F-XXRS-1	40-pin DIP	8-bit microcontroller, 16 MHz, 4K ROM, 128-bit RAM
MSM80C51FV-XXG-V1K-1	44-pin QFP	8-bit microcontroller, 16 MHz, 4K ROM, 128 bit RAM, Intel compatible pinout
MSM80C51F-XXJS-1	44-pin PLCC	8-bit microcontroller, 16 MHz, 4K ROM, 128-bit RAM
MSM80C154RS	40-pin DIP	8-bit microcontroller, 12 MHz, ROMless option, 256-bit RAM
MSM80C154RS-1	40-pin DIP	8-bit microcontroller, 16 MHz, ROMless option, 256-bit RAM
MSM80C154V-GS-V1K	44-pin QFP	8-bit microcontroller, 12 MHz, ROMless option, 256-bit RAM
MSM80C154V-GS-V1K	44-pin QFP	8-bit microcontroller, 16 MHz, ROMless option, 256-bit RAM
MSM80C154JS	44-pin PLCC	8-bit microcontroller, 12 MHz, ROMless option, 256-bit RAM
MSM80C154JS-1	44-pin PLCC	8-bit microcontroller, 16 MHz, ROMless option, 256-bit RAM
MSM83C154-XXRS	40-pin DIP	8-bit microcontroller, 12 MHz, 16K ROM, 256-bit RAM
MSM83C154V-GSV1K	44-pin QFP	8-bit microcontroller, 12 MHz, 16K ROM, 256-bit RAM
MSM83C154-XXJS	44-pin PLCC	8-bit microcontroller, 12 MHz, 16K ROM, 256-bit RAM
MSM83C154-XXJS	44-pin PLCC	8-bit microcontroller, 12 MHz, 16K ROM, 256-bit RAM
MSM83C154-XXRS-1	40-pin DIP	8-bit microcontroller, 16 MHz, 16K ROM, 256-bit RAM
MSM83C154V-GS-V1K-1	44-pin QFP	8-bit microcontroller, 16 MHz, 16K ROM, 256-bit RAM
MSM83C154-XXJS-1	44-pin PLCC	8-bit microcontroller, 16 MHz, 16K ROM, 256-bit RAM
MSM85C154VS	40-pin Piggyback	Piggyback IC for 80C51 and 83C154 code development, 16 MHz
Development Tools for Intel Compatible Microcontrollers (CMOS)		
EASE80C49	—	Emulator for 80C48/49/50 microcontroller
EASE80C51MKII	—	Emulator for 80C51 and 83C154 microcontroller

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nX - OKI's Original Microcontroller

nX 65K Series – 8-Bit Microcontrollers (CMOS)

PART NUMBER	PACKAGE	DESCRIPTION
MSM65X511RS	40-pin DIP	8-bit microcontroller, ROMless, 10 MHZ, 128-byte RAM
MSM65X511JS	44-pin PLCC	8-bit microcontroller, ROMless, 10 MHZ, 128-byte RAM
MSM65X511GS-K	44-pin QFP	8-bit microcontroller, ROMless, 10 MHZ, 128-byte RAM
MSM65511-XXRS	40-pin DIP	8-bit microcontroller, 4K ROM, 10 MHZ, 128-byte RAM
MMS65511-XXJS	44-pin PLCC	8-bit microcontroller, 4K ROM, 10 MHZ, 128-byte RAM
MSM65511-XXGS-K	44-pin QFP	8-bit microcontroller, 4K ROM, 10 MHZ, 128-byte RAM
MSM65X512RS	40-pin DIP	8-bit microcontroller, ROMless, 10 MHZ, 256-byte RAM
MSM65X512JS	44-pin PLCC	8-bit microcontroller, ROMless, 10 MHz, 256-byte RAM
MSM65X512GS-K	44-pin QFP	8-bit microcontroller, ROMless, 10 MHZ, 256-byte RAM
MSM65512-XXRS	40-pin DIP	8-bit microcontroller, 8K ROM, 10 MHZ, 256-byte RAM
MSM65512-XXJS	44-pin PLCC	8-bit microcontroller, 8K ROM, 10 MHZ, 256-byte RAM
MSM65512-XXGS-K	44-pin QFP	8-bit microcontroller, 8K ROM, 10 MHZ, 256-byte RAM
MSM65P512RS	40-pin DIP	8-bit microcontroller, 8K OTP, 10 MHZ, 256-byte RAM
MSM65P512JS	44-pin PLCC	8-bit microcontroller, 8K OTP, 10 MHZ, 256-byte RAM
MSM65P512GS-K	44-pin QFP	8-bit microcontroller, 8K OTP, 10 MHZ, 256-byte RAM
MSM65X13SS	64-pin SDIP	8-bit microcontroller, ROMless, 10 MHZ, 256-byte RAM, 56 I/O lines
MSM65X13JS	68-pin PLCC	8-bit microcontroller, ROMless, 10 MHZ, 256-byte RAM, 56 I/O lines
MSM65X513GS-K	64-pin QFP	8-bit microcontroller, ROMless, 10 MHZ, 256-byte RAM, 56 I/O lines
MSM65513-XXSS	64-pin SDIP	8-bit microcontroller, 8K ROM, 10 MHZ, 256-byte RAM, 56 I/O lines
MSM65513-XXJS	68-pin PLCC	8-bit microcontroller, 8K ROM, 10 MHz, 256-byte RAM, 56 I/O lines
MSM65513-XXGS-K	64-pin QFP	8-bit microcontroller, 8K ROM, 10 MHZ, 256-byte RAM, 56 I/O lines
MSM65P513SS	64-pin SDIP	8-bit microcontroller, 8K OTP, 10 MHZ, 256-byte RAM, 56 I/O lines
MSMP513JS	68-pin PLCC	8-bit microcontroller, 8K OTP, 10 MHZ, 256-byte RAM, 56 I/O lines
MSMP513GS-K	64-pin QFP	8-bit microcontroller, 8 K OTP, 10 MHz, 256-byte RAM, 56 I/O lines
MSM65X524SS	64-pin SDIP	8-bit microcontroller, ROMless, 10 MHZ, 384-byte RAM, 56 I/O lines, 8-bit A/D
MSM65X524JS	68-pin PLCC	8-bit microcontroller, ROMless, 10 MHZ, 384-byte RAM, 56 I/O lines, 8-bit A/D
MSM65X24GS-K	64-pin QFP	8-bit microcontroller, ROMless, 10 MHz, 384-byte RAM, 56 I/O lines, 8-bit A/D
MSM65524SS	64-pin SDIP	8-bit microcontroller, 16K ROM, 10 MHz, 384-byte RAM, 56 I/O lines, 8-bit A/D
MSM65524GS-K	64-pin QFP	8-bit microcontroller, 16K ROM, 10 MHZ, 384 byte RAM, 56 I/O lines, 8-bit A/D
MSM65P524XX	64-pin SDIP	8-bit microcontroller, 16K OTP, 10 MHZ, 384-byte RAM, 56 I/O lines, 8-bit A/D
MSM65P524JS	68-pin PLCC	8-bit microcontroller, 16K OTP, 10 MHZ, 384-byte RAM, 56 I/O lines, 8-bit A/D
MSM65P524GS-K	64-pin QFP	8-bit microcontroller, 16K OTP, 10 MHZ, 384-byte RAM, 56 I/O lines, 8-bit A/D1

OTP= One Time Programmable

nX 65K Series – 8/16-Bit Microcontrollers (CMOS)

MSM66X301SS	64-pin SDIP	8/16-bit microcontroller, ROMless, 10 MHZ, 512-byte RAM, 10-bit A/D
MSM66X301JS	68-pin PLCC	8/16-bit microcontroller, ROMless, 10 MHZ, 512-byte RAM, 10-bit A/D
MSM66X301GS-K	64-pin PLCC	8/16-bit microcontroller, ROMless, 10 MHZ, 512-byte RAM, 10-bit A/D
MSM66301-XXSS	64-pin SDIP	8/16-bit microcontroller, 16K ROM, 10 MHZ, 512-byte RAM, 10-bit A/D
MSM66301-XXJS	68-pin PLCC	8/16-bit microcontroller, 16K ROM, 10 MHZ, 512-byte RAM, 10-bit A/D
MSM66301-XXGS-K	64-pin PLCC	8/16-bit microcontroller, 16K ROM, 10 MHZ, 512-byte RAM, 10-bit A/D
MSM66G301VS	64-pin Piggyback	8/16-bit microcontroller, 16K (EPROM Piggyback) 10 MHz, 512-byte RAM, 10-bit A/D
MSM66X201SS	64-pin SDIP	8/16-bit microcontroller, ROMless, 10 MHZ, 512-byte RAM, 10-bit A/D
MSM66X201JS	68-pin PLCC	8/16-bit microcontroller, ROMless, 10 MHZ, 512-byte RAM, 10-bit A/D
MSM66X201GS-K	64-pin PLCC	8/16-bit microcontroller, ROMless, 10 MHZ, 512-byte RAM, 10-bit A/D
MSM66201-XXSS	64-pin SDIP	8/16-bit microcontroller, 16K ROM, 10 MHZ, 512-byte RAM, 10-bit A/D
MSM66201-XXJS	68-pin PLCC	8/16-bit microcontroller, 16K ROM, 10 MHZ, 512-byte RAM, 10-bit A/D
MSM66201-XXG-K	64-pin PLCC	8/16-bit microcontroller, 16K ROM, 10 MHZ, 512-byte RAM, 10-bit A/D
MSM66P201SS	64-pin SDIP	8/16-bit microcontroller, 16K OTP, 10 MHZ, 512-byte RAM, 10-bit A/D
MSM66P201JS	68-pin PLCC	8/16-bit microcontroller, 16K OTP, 10 MHZ, 512-byte RAM, 10-bit A/D
MSM66P201GS-K	64-pin PLCC	8/16-bit microcontroller, 16K OTP, 10 MHZ, 512-byte RAM, 10-bit A/D
MSM66X207SS	64-pin SDIP	8/16-bit microcontroller, ROMless, 10 MHZ, 1K-byte RAM, 10-bit A/D
MSM66X207JS	68-pin PLCC	8/16-bit microcontroller, ROMless, 10 MHz, 1K-byte RAM, 10-bit A/D
MSM66X207GS-K	64-pin QFP	8/16-bit microcontroller, ROMless, 10 MHZ, 1K-byte RAM, 10-bit A/D
MSM66207-XXSS	64-pin SDIP	8/16-bit microcontroller, 32K ROM, 10 MHZ, 1K-byte RAM, 10-bit A/D
MSM66207-XXJS	68-pin PLCC	8/16-bit microcontroller, 32K ROM, 10 MHZ, 1K-byte RAM, 10-bit A/D
MSM66207-XXGS-K	64-pin QFP	8/16-bit microcontroller, 32K ROM, 10 MHZ, 1K-byte RAM, 10-bit A/D
MSM66P207SS	64-pin SDIP	8/16-bit microcontroller, 32K OTP, 10 MHZ, 1K-byte RAM, 10-bit A/D
MSM66P207JS	68-pin PLCC	8/16-bit microcontroller, 32K OTP, 10 MHZ, 1K-byte RAM, 10-bit A/D
MSM66P207GS-K	64-pin QFP	8/16-bit microcontroller, 32K OTP, 10 MHZ, 1K-byte RAM, 10-bit A/D
MSM66X417GS-K*	84-pin QFP	8/16-bit microcontroller, ROMless, 10 MHZ, 1K-byte RAM, 10-bit A/D
MSM66417-XXGS-K*	84-pin QFP	8/16 bit microcontroller, 32K ROM 10 MHz, 1K-byte RAM, 10-bit A/D
MSM66P417GS-K*	84-pin QFP	8/16-bit microcontroller, 32K OTP, 10 MHz, 1K-byte RAM, 10-bit A/D

* Available Q2 1991

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nX - OKI's Original Microcontroller - (continued)

PART NUMBER	PACKAGE	DESCRIPTION
nX 67K Series – 16-Bit Microcontrollers (CMOS)		
MSM67X620SS	64-pin SDIP	16-bit microcontroller, ROMless, 10 MHz, 512-byte RAM
MSM67X620JS	68-pin PLCC	16-bit microcontroller, ROMless, 10 MHz, 512-byte RAM
MSM67X620GS-K	64-pin QFP	16-bit microcontroller, ROMless, 10 MHz, 512-byte RAM
MSM67620-XXSS	64-pin SDIP	16-bit microcontroller, 16K word ROM, 10 MHz, 512-byte RAM
MSM62620-XXJS	68-pin PLCC	16-bit microcontroller, 16K word ROM, 10 MHz, 512-byte RAM
MSM67620-XXGS-K	64-pin QFP	16-bit microcontroller, 16K word ROM, 10 MHz, 512-byte RAM
MSM67P620SS	64-pin SDIP	16-bit microcontroller, 16K work OTP, 10 MHz, 512-byte RAM
MSM67P620GS-K	64-pin QFP	16-bit microcontroller, 16K work OTP, 10 MHz, 512-byte RAM
nX Development Tools		
EASE66301	—	Program development for MSM66301, MSM66201
OMFICE (EVM65524)	—	Program development system for 65K series
OMFICE (EVM66417)*	—	Program development system for 66K series
OMFICE (EVM67620)	—	Program development system for 67K series
OMFICE	—	Generic program development system for n/X microcontrollers
EVM65524	—	Evaluation module for 65K series
EVM66417	—	Evaluation module for 66K series

* Available Q2 1991

OKI's Original Microcontroller Smart Cards

PART NUMBER	PACKAGE	DESCRIPTION
MSM6720	COB	8-bit microcontroller, 2K EEPROM, 5 MHz, Smart Card format
MSM62780	COB	8-bit microcontroller, 8K EEPROM, 5 MHz, Smart Card format
Smart Card Development Tools		
EASE62780	—	Program development system for Smart Card application

Vacuum Fluorescent (CMOS)

PART NUMBER	PACKAGE	DESCRIPTION
MSC1150RS	18-pin DIP	10-bit anode/grid VF driver
MSC1162GS-K	60-pin SOP	40-bit grid display driver
MSC1164GS-K	32-pin SOP	20-bit grid/anode VF display driver
MSC1165RS	28-pin DIP	20-bit grid/anode VF display driver
MSC11716S-K	28-pin DIP	20-bit anode/grid VF driver
MSC1172GS-V1K	60-pin SOP	40-bit anode/grid VF driver
MSC1173RS	40-pin DIP	32-bit anode/grid VF driver
MSL918ARS	18-pin DIP	8-bit parallel-in, parallel-out VF driver
MSC1187-XXGS-K	44-pin QFP	33-bit segment driver with maskable dimming function
MSC1937-01RS	40-pin DIP	VF display driver/controller alphanumeric characters
MSC1951-01RS	40-pin DIP	VF display driver/controller for bar graph and numeric characters
MSC1951-01GS-K	44-pin QFP	Bargraph and numeric display VF controller
MSM5267B-15RS	40-pin DIP	33-bit VF display driver
MSM5267B-15GS-VK	44-pin QFP	33-bit VF display driver
MSC7701GS-V1K	60-pin SOP	40-bit VF driver
MSC7751GS-V1K	60-pin SOP	40-bit anode VF driver
MSC7110-01SS	42-pin SDIP	12-segment, 16-digit VF controller
MSC7112-01SS	42-pin SDIP	16-segment, 12-digit VF controller
MSC1149RS	40-pin DIP	33-bit segment driver
MSC1149GS-K	44-pin QFP	33-bit segment driver
MSC1149JS-VK	44-pin QFJ	33-bit segment driver
MSC1178GS-K	56-pin QFP	7-segment VF driver
MSC1179GS-K	56-pin QFP	7-segment VF driver
MSC1190GS-K	56-pin QFP	7-segment VF driver
MSC1200GS-K	56-pin QFP	30-bit duplex segment driver with dimming function and keyscan
MSC1200GS-V1K	56-pin QFP	30-bit duplex segment driver with dimming function and keyscan
MSC1201GS-K	44-pin QFP	30-bit duplex segment driver with dimming function and keyscan
MSC1201GS-V1K	44-pin QFP	30-bit duplex segment driver with dimming function and keyscan
MSC1205RS	42-pin DIP	32-bit duplex segment driver with dimming function and keyscan
MSC1206RS	42-pin DIP	17-bit duplex integrated segment driver
MSC1208RS	42-pin DIP	23-bit duplex integrated segment driver
MSC7125GS-K	60-pin DIP	5 x 7 dot matrix, 8-digit driver
MSC7125GS-VK	60-pin DIP	5 x 7 dot matrix, 8-digit driver
MSC7128-01GS-VK	64-pin QFP	5 x 7 dot matrix, 16-digit VF driver
MSC7128-01GS-SS	64-pin SDIP	5 x 7 dot matrix, 16-digit VF driver
MSC1124RS	40-pin DIP	2-channel, 12 dot level meter (static)
MSC1124GS-K	44-pin QFP	2-channel, 12 dot level meter (static)
MSC1146BRS	28-pin DIP	2-channel, 15 dot level meter (dynamic)
MSC1146BSS	30-pin SDIP	2-channel, 15 dot level meter (dynamic)
MSM5328RS	40-pin DIP	33-bit segment display driver

Vacuum Fluorescent (CMOS) - (continued)

PART NUMBER	PACKAGE	DESCRIPTION
MSM5328GS-VK	44-pin QFP	33-bit segment display driver
MSM5328JS	44-pin QFJ	33-bit segment display driver
MSC62408BGS-V1K	80-pin QFP	Bi-CMOS single-chip microcontroller with FLT driver
MSC62408BVS	80-pin ceramic Piggyback	Bi-CMOS single-chip microcontroller with FLT driver
MSC1155RS	16-pin DIP	ECU power control
MSC1199RS	16-pin DIP	ECU power control
MSM58422-XXGS-K	60-pin QFP	4-bit microcontroller, 1.5K ROM, 40-bit RAM, 7 x 5-segment VF driver
MSM6458-XXSS	44-pin SDIP	4-bit microcontroller, 8K ROM, 512-bit RAM, 144-segment VF driver
MSM6458-XXGS-K	64-pin QFP	4-bit microcontroller, 8K ROM, 512-bit RAM, 144-segment VF driver
MSM6458VS	64-pin Piggyback	Piggyback for 6458 code development

Liquid Crystal Display Drivers

PART NUMBER	PACKAGE	DESCRIPTION
Static LCD Drviers (CMOS)		
MSM5829GS-VK	56-pin QFP	5-digit LCD driver
MSM5219BGS-K	60-pin QFP	48-bit LCD display driver
MSM5265GS-K	100-pin QFP	88-segment static LCD dispaly driver
Dot Matrix LCD Drviers (CMOS)		
MSM529GS-K	56-pin QFP	40-column, dot matrix LCD display driver
MSM5260GS-VK	100-pin QFP	80-column, dot matrix LCD display driver
MSM5279GS-K	100-pin QFP	80-column, dot matrix LCD display driver
MSM5839BGS-VK	56-pin QFP	40-dot/segment LCD display driver
MSM6349GS-K	100-pin QFP	80-dot segment driver (passive type)
MSM6349GS-L	100-pin QFP	80-dot segment driver (passive type)
MSM6368GS-K	100-pin QFP	80-dot common driver (passive type)
MSM6369GS-K	100-pin QFP	80-dot segment driver (passive type)
MSM6369GS-L	100-pin QFP	80-dot segment driver (passive type)
MSM6549	TAB	Segment driver
MSM6568	TAB	Common driver
MSM6569	TAB	Segment driver
Dot Matrix LCD Controllers (CMOS)		
MSM6222B-01GS-V1L	80-pin QFP	LCD dot matrix controller, 16-dot and 40-dot segment driver
MSM6262-01GS-V1L	80-pin QFP	LCD dot matrix controller with 48-dot common driver
MSM6240GS-K	60-pin QFP	LCD dot matrix controller
MSM6265GS-VK	80-pin QFP	LCD display controller
MSM6277GS-VK	80-pin QFP	LCD controller for LCD color TV
MSM6355GS-K	80-pin QFP	LCD display driver/controller

Voice Synthesis (CMOS)

PART NUMBER	PACKAGE	DESCRIPTION
ALP-2B	—	Speech filter, 2.5 kHz
ALP-3B	—	Speech filter, 3.5 kHz
ALP-4B	—	Speech filter, 4.5 kHz
DAT-D58M	—	MSM6258 demo board kit without DRAMs
DAT-D58MD	—	MSM6258 demo board kit with DRAMS
SST-58PP	—	MSM6258 demo board SRAM version without SRAMs
SST-58PPS	—	MSM6258 demo board SRAM version with SRAMs
MSC1161RS	18-pin DIP	Direct-drive speaker amplifier
MSC1161GS-K	24-pin QFP	Direct-drive speaker amplifier
MSC1191MS-K	8-pin SOP	Direct-drive speaker amplifier
MSC1192MS-K	8-pin SOP	Direct-drive speaker amplifier
MSC1191RS	8-pin DIP	Direct-drive speaker amplifier
MSC1192RS	8-pin DIP	Direct-drive speaker amplifier
MSM5204ARS	24-pin DIP	8-bit CMOS A/D converter
MSM5205RS	18-pin DIP	Speech synthesizer
MSM5205-K	—	Kit for MSM5205 with MSM6912 filter and resonator
MSM5205-R	—	Kit for MSM5205 with 384kHz resonator
MSM5218GS-K	32-pin QFP	Speech analyzer and synthesizer
MSM5218RS	24-pin DIP	Speech analyzer and synthesizer
MSM5218-K	—	Kit for MSM5218 with MSM6912 filter and resonator
MSM5218-R	—	Kit for MSM5218 with 384kHz resonator
MSM5248-XXRS	18-pin DIP	Speech synthesizer with 48K built-in ROM, 3 second max playback
MSM6258VRS	40-pin DIP	Single-chip, solid-state recorder µPU interface version
MSM6258VJS	44-pin PLCC	Single-chip, solid-state recorder µPU interface version
MSM6258VGS-K	44-pin QFP	Single-chip, solid-state recorder µPU interface version
MSM6258GS-V1K	60-pin QFP	Single-chip, solid-state recorder stand alone operation
MSM6258JS	60-pin PLCC	Single-chip, solid-state recorder stand alone operation
MSM6258GS-K	68-pin QFP	Single-chip, solid-state recorder stand alone operation
MSM6295GS-K	44-pin QFP	ADPCM voice synthesizer LSI with 4-channel playback function
MSM6308GS-K	44-pin QFP	Single-chip, ADPCM solid-state recorder using 256K DRAM
MSM6309GS-K	60-pin QFP	Single-chip, ADPCM solid-state recorder using 256K SRAM
MSM6322GS-K	24-pin SOP	Pitch control IC

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Voice Synthesis (CMOS) - (continued)

PART NUMBER	PACKAGE	DESCRIPTION
MSM6372-XXRS	18-pin DIP	Speech synthesis with 128K ROM
MSM6373-XXRS	18-pin DIP	Speech synthesis with 256K ROM
MSM6374-XXRS	18-pin DIP	Speech synthesis with 512K ROM
MSM63P74RS	18-pin DIP	Speech synthesis with 512K OTP
MSM6375-XXRS	18-pin DIP	Speech synthesis with 1M-bit ROM
MSM6376GS-V1K	64-pin QFP	Development chip for the MSM6373/74/75
MSM6378ARS	16-pin DIP	Speech synthesis with 256K One Time Programmable ROM
MSM6388GS-V1K	44-pin QFP	Solid-state recorder/1M-bit serial rgister I/F
MSM6389RS	18-pin DIP	1 M-bit serial register for MSM6388
MSM6389JS	18-pin PLCC	1M-bit serial register for MSM6388
MSM6588GS-K	44-pin QFP	Solid state recorder
MSM514202JS	18-pin PLCC	512K serial register for MSM6388
ASE-88	—	Development system and software for speech programs
IC-SK (Demo Board 6322)		Demo board for MSM6322 pitch control IC
IC-SK (Demo Board 6373/74/75)		Demo board for MSM6373/74/75 masked ROM devices
IC-SK (Demo Board 6376)		Demo board for MSM6376 development chip
IC-SK (Demo Board 6378)		Demo board for MSM6378 OTP devices
IC-SK (ANAWRITER)		MSM6378 analyzer/PROM writer
IC-SK (ANAWRITER backup)		Master backup system for ANAWRITER
IC-SK (PARAWRITER)		Multiple MSM6378 programmer
IC-SK (Demo board 6388)		Demo board for MSM6388 recorder

Data Com (CMOS)

PART NUMBER	PACKAGE	DESCRIPTION
MSM6912AS	16-pin ceramic DIP	PCM channel audio filter
MSM6920RS	16-pin DIP	DT/MF receiver
MSM6926RS	28-pin DIP	300-BD CCITT modem
MSM6927RS	28-pin DIP	1200-BD CCITT modem
MSM6927GS-K	44-pin QFP	1200-BD CCITT modem
MSM6945RS	28-pin DIP	DT/MF receiver
MSM6946RS	28-pin DIP	300-BD Bell 103 modem
MSM6946GS-K	44-pin QFP	300-BD Bell 103 modem
MSM6947RS	28-pin DIP	1200-BD Bell 202 modem
MSM6949SS	64-pin SDIP	Analog front-end for 4800/9600 bps modem
MSM6949JS	68-pin PLCC	Analog fornt-end for 4800/9600 bps modem
MSM6949GS-V1K	64-pin QFP	Analog front-end for 4800/9600 bps modem
MSM6950BRS	42-pin DIP	1200/2400-BD analog front
MSM6950BGS-VK	56-pin QFP	1200/2400-BD analog front
MSM6950BJS	44-pin PLCC	1200/2400-BD analog front
MSM6951BRS	42-pin DIP	Analog-fornt-end for multi-standard modem
MSM6951BGS-VK	56-pin QFP	Analog front-end for multi-standard modem
MSM6951BJS	44-pin PLCC	Analog fornt-end for multi-standard modem
MSM6960GS-VK	44-pin QFP	PLL frequency synthesizer
MSM6962RS	16-pin DIP	Mu-Law CODEC
MSM6963RS	16-pin DIP	A-Law CODEC
MSM6982ES	28-pin ceramic Chip Carrier	Mu-Law CODEC
MSM6982GS-VK	24-pin SOP	Mu-Law CODEC
MSM6982JS	28-pin PLCC	Mu-Law CODEC
MSM6983EX	28-pin ceramic Chip Carrier	A-Law CODEC
MSM6983GS-VK	24-pin SOP	A-Law CODEC
MSM6983JS	28-pin PLCC	A-Law CODEC
MSM6994-01SS	64-pin Shrink DIP	Front-end processor for multi-standard modem
MSM6994-01GS	64-pin QFP	Front-end processor for multi-standard modem
MSM6994-01JS	68-pin PLCC	Front-end processor for multi-standard modem
MSM6996VRS	16-pin DIP	A-Law CODEC with loop test
MSM6996HAS	16-pin ceramic DIP	A-Law CODEC, Hitachi like
MSM6996VAS	16-pin ceramic DIP	A-Law CODEC with loop test
MSM6996HGS-VK	24-pin SOP	A-Law CODEC, Hitachi like
MSM6996VGS-VK	24-pin SOP	A-Law CODEC with loop test
MSM6997VRS	16-pin DIP	Mu-Law CODEC with loop test
MSM6997HAS	16-pin ceramic DIP	Mu-Law CCODEC, Hitachi like
MSM6997VAS	16-pin ceramic DIP	Mu-Law CODEC with loop test
MSM6997HGS	24-pin SOP	Mu-Law CODEC, Hitachi like
MSM6997VGS	24-pin SOP	Mu-Law CODEC with loop test
MSM699BRS	16-pin DIP	A-Law CODEC
MSM6998GS	24-pin SOP	A-Law CODEC
MSM6999RS	16-pin DIP	Mu-Law CODEC, Hitachi compatible with push-pull drive
MSM6999AS	16-pin ceramic DIP	Mu-Law CODEC, Hitachi compatible with push-pull drive
MSM6999GS-VK	24-pin SOP	Mu-Law CODEC, Hitachi compatible with push-pull drive
EVA4	—	Evaluation board for MSM6994 front-end processor
MSM7508RS	16-pin DIP	Single 5 V Mu-Law synchronous CODEC
MSM7509RS	16-pin DIP	Single 5 V Mu-Law synchronous CODEC
MSM77C20A-XXRS	28-pin DIP	Digital signal processor, 240 ns instruction cycle time
MSM77C20A-XXJS	44-pin PLCC	Digital signal processor, 240 ns instruction cycle time
MSM77C20-XXAS	28-pin ceramic DIP	Digital signal processor, 240 ns instruction cycle time

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Digital Signal Processors (CMOS)

PART NUMBER	PACKAGE	DESCRIPTION
MSM6992AS	132-pin ceramic PGA	Floating point DSP, 8 MHz
MSM6992HAS	132-pin ceramic PGA	Floating point DSP, 10 MHz
MSM699210JS	84-pin PLCC	Floating point DSP muxed bus, 10 MHz
MSM699210GS-VK	100-pin QFP	Floating point DSP muxed bus, 10 MHz
MSM699215JS	84-pin PLCC	Floating point DSP with serial ports
MSM699215GS	100-pin QFP	Flotaing point DSP with serial ports
EMU92	—	8 MIPS 6992 emulator with cross assembler and debugger
EMU92L	—	8 MIPS 6992 low cost PC emulator with assembler
EMU9210L	—	Development board for 699210
OSL92	—	C-Like high-level language for 6992
SFT92	—	Library-subroutine (5)
SIM92	—	PC-based simulator for 6992, 699210

Gallium Arsenide

PART NUMBER	PACKAGE	DESCRIPTION
KGF1145	4-pin minimold	Dual-gate amplifier
KGF1155	4-pin minimold	Dual-gate amplifier
KGF1165	4-pin minimold	Feedback wide-band amplifier
KGF1175	4-pin minimold	Dual-gate head amplifier
KGF1254	4-pin minimold	Medium-power driver amplifier
KGF1255	4-pin minimold	Single-gate driver amplifier
KGF1256	4-pin minimold	Medium-power driver amplifier
KGF1850	4-pin minimold	Low-noise HEMT
KGF1860	4-pin minimold	Low noise HEMT
KGF1870	4-pin minimold	Low noise HEMT
KGL1305	Ceramic surface mount	Single-gate power amplifier
KGL2115	8-pin QFP	2 modulus prescaler
KGL3112	28-pin QFP	2.5Gbps 4:1 multiplexer
KGL3114	28-pin QFP	2.5Gbps 1:4 demultiplexer
KGL4101	28-pinn QFP	High-speed, 1 GHz, 256-bit shift register
KGL5202	16-pin QFP	1 GHz, 4-channel clock driver
KGL4105	80-pin QFP	High-speed, 32-bit serial data transmitter
KGL4106	80-pin QFP	High-speed, 32-bit serail data transmitter
KGL6020	28-pin QFP	Ultra high-speed, 5 Gbps logic: NOR/OR
KGL6030	28-pin QFP	Ultra high-speed, 5 Gbps logic: EXOR/NOR
KGL6040	28-pin QFP	Ultra high-speed, 5 Gbps logic: Selector
KGL6050	28-pin QFP	Ultra hgih-speed, 5 Gbps logic: T-flip-flop
KGL6050	28-pin QFP	Ultra high-speed, 5 Gbps logic: D-flip-flop
KGL5501	20-pin QFP	1.8 GHz decision circuit
KGL5502	20-pin QFP	2.4 GHz decision circuit

Standard Cell

PART NUMBER	TECHNOLOGY	DESCRIPTION
MSM91U000	1.2µm CMOS	82CXX, RAM to 32K bits, ROM to 128K bits, Gates to 60K
MSM98U000	1.2µm CMOS	High pin count, small die size using narrow I/O cells

Gate Arrays

ASIC products are available in DIP, PLCC, QFP and PGA packages

PART NUMBER	TECHNOLOGY	DESCRIPTION
MSM10S0000	0.8µm CMOS Sea-of-Gates Up to 225, 280 Gates Up to 840 I/O Cells	0.8µm drawn, 0.6 µm effective, multilayer metal CMOS process adapted from high volume, high-density 4 Meg DRAM; Extensive Macrocell Library (High-density memory; High-density single port and multiport RAM; 82CXX peripheral cells; UART cells and FIFO funtions); Automatic Test Vector Generation (Scan flip-flop macros; High fault coverage > 95%); Typical gate delays (200 ps [Inv. F0=1, L=0 mm]; 350 ps [4X, 2IP NAND, F0=2, L=2 mm]); Toggle and Shift frequency—500 MHz; Configurable I/O cells (CMOS or TTL level inputs, open drain, push-pull, tri-state ouput options; Programmable output currents—2, 4, 8, 16, 24 and 48 mA; Gated oscillators from 25 kHz to over 65 MHz)
MSM10T0000	1.0µm CMOS Sea-of-Gates 11 Types Up to 100, 500 Gates I/Os from 68 to 260	Automatic Test Vector Generation; Dedicated high-density hand-packed scan flip-flops (No flip-flop performance penalty, no area penalty, fault coverage over 95%); Configurable I/O cells (CMOS or TTL level inputs, open drain, push-pull, tri-state output options; Programmable output currents—2, 4, 8, 12 and 24 mA using paralllel output cells; Gated oscillators from 30 kHz to over 50 MHz) Extensive Macrocell Library (High density ROM and RAM); Maximum logic density using high-gate count core
MSM18T0000	1.0µm CMOS Sea-of-Gates 5 Types Up to 19, 456 Gates I/Os from 104 to 176	Minimum die size for high pin count using narrow I/O cells; Configurable I/O cells (CMOS or TTL level inputs, open drain, push-pull, tri-state output options; Programmable output currents—2, 4, 8, 12 and 24 mA using parallel output cells; Gated oscillators from 30 kHz to over 50 MHz); Extensive Macrocell Library (High density ROM and RAM)
MSM7U0000	1.2µm CMOS Channelled Arrays 11 Types Up to 30,384 Gates I/Os from 60 to 252	Six transistor cell configuration (Dense macros using fewer cells, faster performance); Configurable I/O cells (CMOS or TTL level inputs, pull up/down resistors 3 kΩ or 50 kΩ; Open drain, push-pull, tri-state options; Programmable output currents—2, 4, 8, 12 mA; High drive of 16, 24 and 48 mA using paralleled output cells; Gated oscillators from 30 kHz to over 50 MHz); Extensive Macrocell and Macrofunction

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ASIC CAD Support

Using Oki supported CAE front-end tools, the system designer can capture and simulated their designs. Oki's application software will allow the designer to enhance the design and the verification process. After the design netlist and test vectors are converted into Oki's standard format and the design has been transferred to Oki's design environment, Oki's design engineers will continue the design verification process. Prior to prototyping, Oki will perform layout, back-annotation, and re-verification with the actual wire capacitance of the design. The following table will show the third party tools supported by Oki through a simple design cycle.

VENDOR	PLATFORM	OPERATING SYSTEM/REV	DESCRIPTION
ASIC Design Tool Support			
Cadence	Sun/SPARC	Sun OS 4.1.1	Design capture
	Solbourne	Amadeus 4.1	Simulation
		Veritools 1.6	Fault grading; Design verification
DAZIX	Sun 386	Advansys 3.1	Design capture
	Sun/SPARC		Simulation; Design check
IKOS		4.0 up	Simulation; Fault grading
Mentor Graphics	HP/Apollo	IDEA 7.0	Design capture
	DNx Series	(*8.0 Available Soon)	Simulation
	HP 9000		Design check
	Sun/SPARC	Parade	Layout
	Solbourne		Clock Structures
Synopsys	Sun/SPARC	2.0	Design synthesis
	*Interface to Mentor, Valid, Viewlogic		Test synthesis
Valid	Sun/SPARC	Sun OS 4.1.1	Design capture
	Sun-3	GED, ValidSIM, RapidSIM	Simulation
	DECstation 3100	ULTRIX, GED, ValidSIM	Design check
	IBM RS6000	GED, ValidSIM, RapidSIM	
Viewlogic	Sun/SPARC	Sun OS 4.1.1	Design capture
		Workview 4.1	Simulation
	PC386	DOS 3.3, Workview 4.1	Design check

DRAM Cross Reference Guide

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OKI PART NUMBER	TOSHIBA	NEC	HITACHI	SAMSUNG	MITSUBISHI
1 Meg DRAMs					
MSM511000A	TC511000	µPD421000	HB511000	KM41C1000A	M5M41000A
MSM511001A	TC511001	µPD421001	HB511001	KM41C1001A	M5M41001A
MSM511002A	TC511002	µPD421002	HB511002	KM41C1002A	M5M41002A
MSM514256A	TC514256	µPD424256	HB514256	KM44C256A	M5M44256A
MSM514258A	TC514258	µPD424528	HB514258	KM44C258A	M5M44258A

XX=Speed
60=60 ns tRAC/15 ns tCAC
70=70 ns tRAC/20 ns tCAC
80=80 ns tRAC/20 ns tCAC

ZZ=Package
RS=20-pin DIP: 300 mil
JS=26-pin SOJ: 300 mil
ZS=20-pin ZIP

VENDOR	SOJ	DIP	ZIP
Package Matrix			
Toshiba	J	P	L
NEC	LA	C	V
Hitachi	JP	P	ZP
Samsung	J	P	Z
Mitsubishi	J	P	L
OKI	**JS**	**RS**	**ZS**

OKI PART NUMBER	TOSHIBA	NEC	HITACHI	SAMSUNG	MITSUBISHI
4 Meg DRAMs					
MSM514100A	TC51400	µPD424100	HB514100	KM41C4000A	M5M44000
MSM514101A	TC51401	µPD424101	HB514101	KM41C4001A	M5M44001
MSM514102A	TC51402	µPD424102	HB514102	KM41C4002A	M5M44002
MSM514400A	TC514400	µPD424400	HB514400	KM41C1000A	M5M44402
MSM514402A	TC514402	µPD424402	HB514402	KM41C1002A	M5M44000

XX=Speed
80=80 ns tRAC/20 ns tCAC
70=70 ns tRAC/20 ns tCAC

ZZ=Package
RS=20-pin DIP
JS=26-pin SOJ: 350 mil
SJ=26-PIN SOJ:300 mil
ZS=20-pin ZIP
TS-K/TS-L=24-pin TSOP

VENDOR	SOJ	DIP	ZIP	SOJ (300 MIL)	TSOP TYPE II
Package Matrix					
Toshiba	J	P	Z	N/A	N/A
NEC	LA	C	V	N/A	N/A
Hitachi	JP	P	ZP	N/A	N/A
Samsung	J	P	Z	N/A	N/A
Mitsubishi	J	P	L	N/A	N/A
OKI	**JS**	**RS**	**ZS**	**JS/SJ**	**TS-K/TS-L**

N/A = not available at time of printing

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DRAM Cross Reference Guide - (continued)

OKI PART NUMBER	TOSHIBA	NEC	HITACHI	SAMSUNG	MITSUBISHI
Memory DRAM Modules					
MSC2312A-XXYS9-B	THM91000AS	MC421000A9B	HB56A19B	KMM591000A	MH1M09A0J
MSC2313A-XXYS8-B	THM81000AS	MC421000A8B	HB56A18B	KMM581000A	MH1M08A0J
MSC2320A-XXYS9-B	THM362500AS	MC424256A36	HB56D25636B	KMM5362568A	MH25636AJ
MSC2321A-XXYS18-B	THM365120AS	MC424512A36	HB56B51236B	KMM536512B	MH51236AJ
MSC23409-XXBS/DS9	THM94000AS	MC424100A9B	HB56A49B	KMM594000A	MH4M09A
MSC23408-XXBS/DS8	THM84000AS	MC424100A8B	HB56A48B	KMM584000A	MH4M08A
MSC23236-XXBS/DS24	THM362020S	MC422000A36BH/FH	HB56D236B	KMM5362000	MH2M36AJ
MSC23136-XXBS/DS12	THM361020S	MC421000A36	HB56D136B	KMM5361000	MH1M36BJ
MSC23132-XXBS/DS8	THM321020S		HB56D132BR		MH1M32BJ
MSC23232-XXBS/DS16	THM322020S		HB56D232B		MH2M32BJ
MSC23140-XXBS-DS10	THM401020S		HB56D140		
MSC23240-XXBS/DS20	THM402020S		HB56D240		
MSC23109-XXBS/DS9	THM91000AS	MC421000A98	HB56A19B	KMM591000A	MH1M09A0

XX=Speed
60=60 ns tRAC/15 ns tCAC
80=80 ns tRAC/20 ns tCAC
70=70 ns tRAC/20 ns tCAC
8A=80 ns tRAC/25 ns tCAC

ZZ=Package
YS=Memory Module without pins
KS=Memory Module with pins
DS=Solder Pad
BS=Gold Pad

CMOS Microprocessor and Peripherals Cross Reference Guide

PRODUCT DESCRIPTION	OKI	INTEL	NEC	TOSHIBA	NATIONAL	HARRIS	MITSUBISHI
Microprocessors							
CMOS 8-bit microprocessor	MSM80C88A	—	µPD70108	—	—	80C88	—
CMOS 16-bit microprocessor	MSM80C86A	—	µPD70116	—	—	80C86	—
Peripheral Products							
CMOS USART (82C51)	MSM82C51	—	µPD71051	—	—	82C52	M5M82C51
CMOS programmable Interval timer	MSM82C53	—	µPD71054	—	—	82C54	M5M82C54
CMOS programmable peripheral interface	MSM82C55	—	µPD71055	—	—	82C55	M5M82C55
CMOS programmable interrupt controller	MSM82C59	—	µPD71059	—	—	82C59	M5M82C59
CMOS clock generator & driver	MSM82C84	—	µPD71084	—	—	82C84	—
CMOS system bus controller	MSM82C88	—	µPD71088	—	—	82C88	—

PRODUCT DESCRIPTION	OKI	INTEL	NEC	TOSHIBA	AMD	FUJITSU	MITSUBISHI
Microprocessors							
8-bit microprocessor	MSM80C85A	805AH	µPD8085A	TMP8085A	AM8085	—	M5L8085A
	MSM80C88A	8088	µPD8088	—	AM8088	MBL8088	M5L8088
16-bit microprocessor	MSM80C86A	8086	µPD8086	—	AM8086	MBL8086	M5L8086
Peripheral Products							
256 x 8 RAM I/O ports &Timer	MSM81C55	8155H	µPD81555	TMP8155	AM8155	—	M5L8155
256 x 8 RAM I/O ports &Timer	MSM81C56	8156H	µPD8156H	TMP8156	AM8156	—	M5L8156
8-bit I/O port	MSM82C12	8212	µPD8212	TMP8212	AM8212C	—	M5L8212
Programmable comm. I/F (USART)	MSM82C51A	8251A	µPD8251A	TMP8251A	AM8251A	—	M5L8251
Programmable interval timer	MSM82C53-5	823-5	µPD8253-5	TMP8253-5	AM8253-5	—	M5L8253A-5
Programmable peripheral interface	MSM82C55A-5	8255A-5	µPD8255A-5	TMP8255A-5	—	M5L825A-5	
Programmable DMA controller	MSM82C37-5	8237-5	µPD8257-5	—	AM8257	—	M5L8257-5
Programmable interrupt controller	MSM82C59A	8259A	µPD8259A	TMP8259A	—	MBL8259A	M5L8259A
Clock generator/driver	MSM82C84A	8284A	µPD8284A	—	—	MBL8284A	M5L8284
System bus controller	MSM82C88	8288	µPD8288	—	—	MBL8288	M5L8288
2048 x 8-bit EPROM with I/O ports	MSM87C55A	8755	µPD8755A	TMP8755A	—	—	—

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DRAM MEMORY MODULES

PART NUMBER	ORGANIZATION	DIMENSIONS	PKG.
64 K DRAM BASED MODULES SPEEDS — 120, 150, 200 nS.			
PEP4064EC4	64K X 4	2.2 X 0.42 X 0.180	22 PIN SIP
PEP4064EC5	64K X 5	2.9 X 0.42 X 0.180	24 PIN SIP
PEP4064EL8*	64K X 8	3.0 X 0.60 X 0.180	30 PIN SIP
PEP4064EL9*	64K X 9	3.0 X 0.60 X 0.180	30 PIN SIP
256 K DRAM BASED MODULES — 60, 70, 80, 100, 120, 150 nS.			
PEP4256EC4	256K X 4	2.2 X 0.42 X 0.180	22 PIN SIP
PEP4256EC5	256K X 5	2.9 X 0.42 X 0.180	24 PIN SIP
†PEP4256EL8*	256K X 8	3.0 X 0.60 X 0.180	30 PIN SIP
†PEP4256EL9*	256K X 9	3.0 X 0.60 X 0.180	30 PIN SIP
PEP4256EL8-LP	256K X 8	3.0 X 0.45 X 0.320	30 PIN SIP
PEP4256EL9-LP	256K X 9	3.0 X 0.45 X 0.320	30 PIN SIP
1M BIT DRAM BASED MODULES — 80, 100, 120 nS.			
PEP1MX4	1M X 4	2.8 X 0.42 X 0.180	24 PIN SIP
PEP1MX5	1M X 5	3.5 X 0.42 X 0.180	26 PIN SIP
PEP4MX1	4M X 1	2.8 X 0.42 X 0.180	26 PIN SIP
PEP1MX4Z	1M X 4	1.5 X 0.350 X 0.440	26 PIN ZIP
PEP4MX1Z	4M X 1	1.5 X 0.350 X 0.440	23 PIN ZIP
PEP1MX8*	1M X 8	3.2 X 0.775 X 0.190	30 PIN SIP
PEP1MX9*	1M X 9	3.2 X 0.775 X 0.190	30 PIN SIP
PEP1MX8-LP	1M X 8	3.5 X 0.435 X 0.320	30 PIN SIP
PEP1MX9-LP	1M X 9	3.5 X 0.435 X 0.320	30 PIN SIP
PEP1MX16	1M X 16	3.3 X 1.50 X 0.320	64 PIN DIP
PEP2MX8	2M X 8	3.3 X 1.50 X 0.320	64 PIN DIP
4M BIT DRAM BASED MODULES			
PEP4MX8*	4M X 8	3.5 X 0.975 X 0.180	30 PIN SIP
PEP4MX9*	4M X 9	3.5 X 0.975 X 0.180	30 PIN SIP
PEP4MX9	4M X 9	3.50 X 0.950 X 0.190	30 PIN SIMM
PEP25636	256K X 36[1]	4.25 X 1.0 X 0.190	72 PIN SIMM
PEP51236	512K X 36[2]	4.25 X 1.0 X 0.325	72 PIN SIMM
PEP1MX36	1M X 36[3]	4.25 X 1.25 X 0.190	72 PIN SIMM
PEP2MX36	2M X 36	4.25 X 1.25 X 0.325	72 PIN SIMM
NTX 4M	4M X 8[4]	3.55 X 0.810 X 0.190	64 PIN SIMM
NTX 4000	1M X 8[4]	3.55 X 0.810 X 0.190	64 PIN SIMM
AST 1000	256K X 36[5]	3.55 X 0.810 X 0.190	64 PIN SIMM
AST 4000	1M X 36[5]	3.55 X 0.810 X 0.190	64 PIN SIMM
STATIC RAM MODULES — 30, 45, 55, 70, 100, 120 nS.			
S128KX8	128K X 8 80, 100, 120	1.80 X 0.680	32 PIN DIP (0.600)
S256KX8	256K X 8 80, 100	1.70 X 0.620	32 PIN DIP (0.600)
S512KX8	512K X 8 80, 100	1.70 X 0.620	32 PIN DIP (0.600)
1PE0176	256K X 8 55 70	2.60 X 0.620	54 PIN DIP (0.600)
LI6432	64K X 32 20-55 NS	3.00 X 0.620	60 PIN DIP (0.600)
LI25632	256K X 32 20-55 NS	3.00 X 0.620	60 PIN DIP (0.600)
S256EC4	256K X 4 20-55	3.00 X 0.450	30 PIN SIP

NOTES:
[1] IBM PS/2 PART #6450603
[2] IBM PS/2 PART #6450604/6450608
[3] IBM PS/2 PART #29F2933
[4] UPGRADES FOR APPLE MAC IIFX AND LASERWRITER NTX
[5] AST RESEARCH PART #500718-002 AND 4M UPGRADE
*Also available in SIMM package. † Also available in 3 chip solution.

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High Speed CMOS Bus Exchange Switches

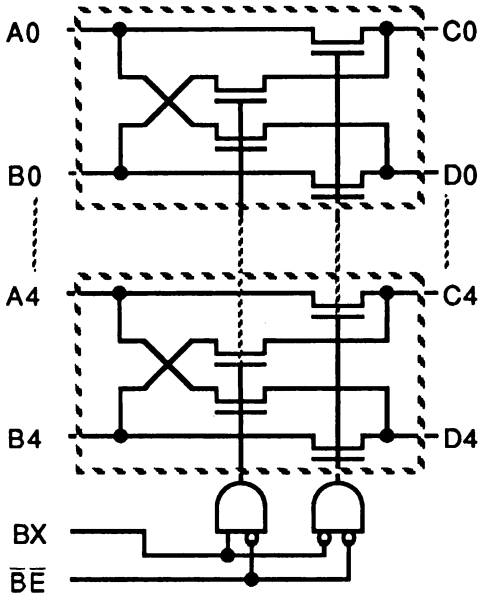
DESCRIPTION

The QS54/74QST3383 and 3583 each provide two sets of ten high-speed CMOS TTL-compatible bus switches. The low on resistance (5Ω) of the 3383 allows inputs to be connected to outputs without adding propagation delay and without generating additional ground bounce noise. The 3583 adds an internal 25Ω resistor to reduce reflection noise in high speed applications. The bus enable (BE) signal turns the switches on. The bus exchange (BX) signal provides nibble swap of the AB and CD pairs of signals. This exchange configuration allows byte swapping of buses in systems. It can also be used as a quad 2-to-1 multiplexer and to create low delay barrel shifters, etc.

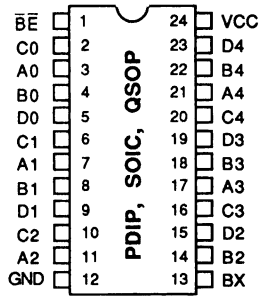
FEATURES/BENEFITS

- 5Ω switches connect inputs to outputs
- Direct bus connection when switches on
- Zero propagation delay
- Undershoot Clamp diodes on all inputs
- Low power CMOS proprietary technology
- 3583 is 25Ω version for low noise
- Bus exchange allows nibble swap
- Zero ground bounce in flow-through mode
- TTL-compatible input and output levels
- Available in 24-pin DIP, ZIP, SOIC and QSOP

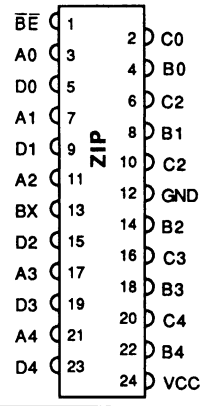
FUNCTIONAL BLOCK DIAGRAM



PIN CONFIGURATIONS



ALL PINS TOP VIEW



PIN DESCRIPTION

Name	I/O	Function
A0-4, B0-4	I/O	Buses A, B
C0-4, D0-4	I/O	Buses C, D
BE	I	Bus Switch Enable
BX	I	Bus Exchange

FUNCTION TABLE

BE	BX	A0-4	B0-4	Function
H	X	Hi-Z	Hi-Z	Disconnect
L	L	C0-4	D0-4	Connect
L	H	D0-4	C0-4	Exchange

DC ELECTRICAL CHARACTERISTICS OVER OPERATING RANGE

Commercial TA = 0°C to 70°C, Vcc = 5.0V±5%
Military TA = -55°C to 125°C, Vcc = 5.0V±10%

Symbol	Parameter	Test Conditions		Min	Typ	Max	Unit
Vih	Input HIGH Voltage	Guaranteed Logic HIGH for Control Inputs		2.0	-	-	Volts
Vih	Input LOW Voltage	Guaranteed Logic LOW for Control Inputs		-	-	0.8	Volts
|Iin|	Input Leakage Current	0 ≤ Vin ≤ Vcc		-	-	1	µA
|Ioz|	Off State Current (Hi-Z)	0 ≤ A, B ≤ Vcc		-	.001	1	µA
|Ios|	Short Circuit Current (2)	A (B) = 0V, B (A) = Vcc		100	-	-	mA
Vic	Clamp Diode Voltage	Vcc = Min, Iin = -18 mA		-	-0.7	-1.2	Volts
Ron	Switch On Resistance (Note 3)	Vcc = Min, Vin = 0.0 Volts	33XX	-	5	7	Ω
		Ion = 48 mA	35XX	24	28	35	Ω
		Vcc = Min, Vin = 2.4 Volts	33XX	-	10	15	Ω
		Ion = 15 mA	35XX	24	35	48	Ω

Notes: 1. Typical values indicate V_{CC} = 5.0V and T_A = 25°C.
2. Not more than one output should be used to test this high power condition, and the duration is ≤1 second.
3. Measured by voltage drop between A and B pin at indicated current through the switch. On resistance is determined by the lower of the voltages on the two (A, B) pins

ORDERING INFORMATION

QSXXQST XXX XX X

54 -55° to +125°C
74 0° to 70°C

3383
3583

P Plastic DIP, 300 mil
D Ceramic DIP, 300 mil
L Leadless Ceramic Chip Carrier
Q Quarter Size Small Outline IC, 150 mil (QSOP)
SO Small Outline IC, 300 mil
Z Plastic ZIP

(Blank) Commercial

B MIL-STD 883, Class B

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High Speed CMOS Bus 10-bit Bus Switches

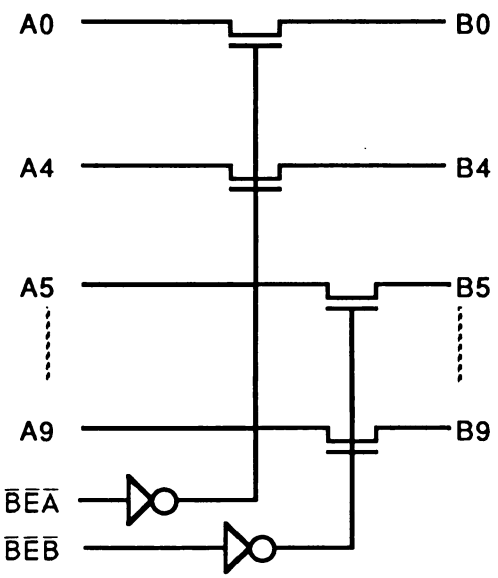
DESCRIPTION

The QS54/74QST3384 and 3584 each provide a set of ten high-speed CMOS TTL-compatible bus switches. The low on resistance (5Ω) of the 3384 allows inputs to be connected to outputs without adding propagation delay and without generating additional ground bounce noise. The 3584 adds an internal 25Ω resistor to reduce reflection noise in high speed applications. The bus enable (BE) signals turn the switches on. Two bus enable signals are provided, one for each of the upper and lower five bits of the two 10-bit buses.

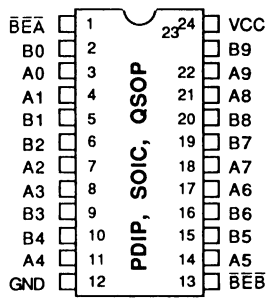
FEATURES/BENEFITS

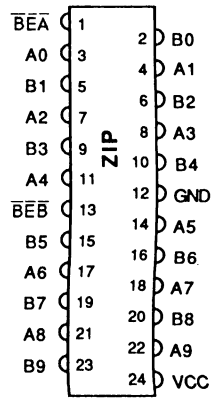
- 5Ω switches connect inputs to outputs
- Direct bus connection when switches on
- Zero propagation delay
- Undershoot Clamp diodes on all inputs
- Low power CMOS proprietary technology
- 3584 is 25Ω version for low noise
- Two enables control 5 bits each
- Zero ground bounce in flow-through mode
- TTL-compatible input and output levels
- Available in 24-pin DIP, ZIP, SOIC and QSOP

FUNCTIONAL BLOCK DIAGRAM



PIN CONFIGURATIONS





ALL PINS TOP VIEW

PIN DESCRIPTION

Name	I/O	Function
A0-9	I/O	Bus A
B0-9	I/O	Bus B
BEA, BEB	I	Bus Switch Exchange

FUNCTION TABLE

BE	BX	A0-4	B0-4	Function
H	H	Hi-Z	Hi-Z	Disconnect
L	H	A0-4	Hi-Z	Connect
H	L	Hi-Z	A5-9	Connect
L	L	A0-4	A5-9	Connect

DC ELECTRICAL CHARACTERISTICS OVER OPERATING RANGE

Commercial TA = 0°C to 70°C, Vcc = 5.0V±5%
Military TA = -55°C to 125°C, Vcc = 5.0V±10%

Symbol	Parameter	Test Conditions		Min	Typ	Max	Unit
Vih	Input HIGH Voltage	Guaranteed Logic HIGH for Control Inputs		2.0	-	-	Volts
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|Iin|	Input Leakage Current	0 ≤ Vin ≤ Vcc		-	-	1	µA
|Ioz|	Off State Current (Hi-Z)	0 ≤ A, B ≤ Vcc		-	.001	1	µA
|Ios|	Short Circuit Current (2)	A (B) = 0V, B (A) = Vcc		100	-	-	mA
Vic	Clamp Diode Voltage	Vcc = Min, Iin = -18 mA		-	-0.7	-1.2	Volts
Ron	Switch On Resistance (Note 3)	Vcc = Min, Vin = 0.0 Volts	33XX	-	5	7	Ω
		Ion = 48 mA	35XX	24	28	35	Ω
		Vcc = Min, Vin = 2.4 Volts	33XX	-	10	15	Ω
		Ion = 15 mA	35XX	24	35	48	Ω

Notes: 1. Typical values indicate V_{CC} = 5.0V and T_A = 25°C.
2. Not more than one output should be used to test this high power condition, and the duration is ≤1 second.
3. Measured by voltage drop between A and B pin at indicated current through the switch. On resistance is determined by the lower of the voltages on the two (A, B) pins

ORDERING INFORMATION

QSXXQST XXX XX X

- 54 -55° to +125°C
- 74 0° to 70°C
- 3384
- 3584
- P Plastic DIP, 300 mil
- D Ceramic DIP, 300 mil
- L Leadless Ceramic Chip Carrier
- Q Quarter Size Small Outline IC, 150 mil (QSOP)
- SO Small Outline IC, 300 mil
- Z Plastic ZIP
- (Blank) Commercial
- B MIL-STD 883, Class B

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PART NUMBER	ORGANIZATION	FEATURES	SPEED	PACKAGE	AVAILABILITY
STATIC RAMS X4 MEMORIES					
8769	4Kx4	CMN I/O Fast CS	15, 20	20 DIP, 24 ZIP, 20 SOJ	NOW
8768	4Kx4	CMN I/O	15, 20	20 DIP, 24 ZIP, 20 SOJ	NOW
8768	4Kx4	CMN I/O	10, 12	20 DIP, 24 ZIP, 20 SOJ	Q1 '92
8780	4Kx4	CACHE TAG	12, 15, 20, 25	22 DIP, 24 ZIP, 24 SOJ	Q2 '92
8881/2	16Kx4	S I/O RFW/OTP DIS	12, 15, 20, 25	28 DIP, 28 SOJ	NOW
8883	16Kx4	CACHE TAG	12, 15, 20, 25	24 DIP, ZIP, 24 SOJ	NOW
8885/6	16Kx4	OE, 2CS/OE	10, 12, 15, 20, 25	24 ZIP, 24 SOJ	NOW
8888	16Kx4	CMN I/O	10, 12, 15, 20, 25	24 SOJ	NOW
8885/6	16Kx4	OE, 2CS/OE	15, 20, 25	24 DIP, ZIP, 24 SOJ	NOW
8888	16Kx4	CMN I/O	15, 20, 25	22 DIP, 24 ZIP, 24 SOJ	NOW
86440	64Kx4	CMN I/O	12, 15, 20, 25	24 DIP, ZIP, SOJ, 28 LCC	Q1 '92
86446	64Kx4	CMN I/O, OE	12, 15, 20, 25	28 DIP, SOJ	Q1 '92
X8 MEMORIES					
83280	32Kx8	CMN I/O	12, 15, 20, 25, 30	28 DIP, SOJ, PLCC, LCC	Q1 '92
83285	32Kx8	Low Power	70, 85, 100, 120	28 DIP	NOW
X16 MEMORIES					
88181	8Kx18	Burst Mode	20, 25, 35	52 PLCC	Q1 '92
88182	8Kx18	Cache Tag	20, 25, 35	52 PLCC	Q1 '92
88160	8Kx16	Dual 4Kx16 A12 not latched	20, 25, 35	52 PLCC	NOW
88180	8Kx18	Dual 4Kx18 A12 not latched	20, 25, 35	52 PLCC	NOW
FIFO					
7201	512x9	EXPANDABLE	15, 20, 25, 35, 50, 80 ns	28 PDIP, 32 PLCC, 28 SOJ	NOW
7202	1Kx9	EXPANDABLE	15, 20, 25, 35, 50, 80 ns	28 PDIP, 32 PLCC, 28 SOJ	NOW
7203	2Kx9	EXPANDABLE	12, 15, 20, 25, 35, 50, 80 ns	28 PDIP, 32 PLCC, 28 SOJ	Q2 '92
7204	4Kx9	EXPANDABLE	12, 15, 20, 25, 35, 50, 80 ns	28 PDIP, 32 PLCC, 28 SOJ	Q1 '92
7223	2Kx9	CLOCKED	50 MHz	28 PDIP, 32 PLCC, 28 SOJ	Q2 '92
7224	4Kx9	CLOCKED	50 MHz	28 PDIP, 32 PLCC, 28 SOJ	Q2 '92
7211	512x9	OTP LATCH S I/OE & RD CLK	15, 20, 25, 35 ns	28 PDIP, 32 PLCC, 28 SOJ	NOW
7212	1Kx9	OTP LATCH S I/OE & RD CLK	15, 20, 25, 35 ns	28 PDIP, 32 PLCC, 28 SOJ	NOW

PART NUMBER	TYPE	ORGANIZATION	FEATURES	PACKAGES A/B/C-SPEEDS	PACKAGES D SPEED	AVAILABILITY
FCT LOGIC BUFFERS & TRANSCEIVERS						
240/1/4	BUFFER	8 Bit	INVRT OTPT, E=0/N-INVRT, E2=1/N-INVRT, E=0	20-pin DIP, ZIP SOIC,QSOP	240, 20/24-pin, ZIP SOIC, QSOP	NOW
540/1	BUFFER	8 Bit	INVRT OTPT/N-INVRT I/O SAME SIDE	20-pin DIP, ZIP SOIC, QSOP		
827/8	BUFFER	10 Bit	N-INVRT OTPT/INVRT	24-pin DIP, ZIP SOIC, QSOP		NOW
245	TRANSCEIVER	8 Bit	N-INVRT OTPT	20-pin DIP, ZIP SOIC, QSOP	20-pin, ZIP SOIC, QSOP	NOW
861/2	TRANSCEIVERS	10 Bit	N-INVRT/INVRT OER=0 OET=0	24-pin DIP, ZIP SOIC, QSOP		NOW
863/4	TRANSCEIVERS	9 Bit	N-INVRT/INVRT OER1,2=0 OET1,2=0	24-pin DIP, ZIP SOIC, QSOP		NOW
REGISTERS						
273	REGISTER	8 Bit	ASYN CLR SOIC, QSOP	20 DIP, ZIP SOIC, QSOP		NOW
374/534	REGISTER	8 Bit	N-INVRT OTPT/INVRT SOIC, QSOP	20 DIP, ZIP SOIC, QSOP	374 20, ZIP, QSOP, SOIC	
377	REGISTER	8 Bit	CLK ENABLE SOIC, QSOP	20 DIP, ZIP		NOW
821/3/5	REGISTER	10/9/8 Bit	SAME SIDE I/O SOIC, QSOP	24 DIP, ZIP SOIC, QSOP	821/3 24 ZIP, SOIC, QSOP	NOW
646/8	R-TRANSCEIVER	8 Bit N-INVRT OTPT/INVRT	GTED OTPT EN: SOIC, QSOP	24 DIP, ZIP SOIC, QSOP	646 24, ZIP, SOIC, QSOP	NOW
651/2	R-TRANSCEIVER	8 Bit	INVRT OTPT/N-INVRT SOIC, QSOP	24 DIP, ZIP		NOW
29FCT52/53	R-TRANSCEIVER	8 Bit N-INVRT OTPT/INVRT	SAME SIDE I/O SOIC, QSOP	24 DIP, ZIP SOIC, QSOP		NOW
29FCT520/1	PIPELINE	4 by 8 Bit PARAMETERS	LOAD CONTROL SOIC, QSOP	24 DIP, ZIP BC SOIC, QSOP		NOW
MSI LOGIC						
138/238	DECODER	1 of 8	ACTIVE LOW/ACTIVE HIGH	16 DIP, SOIC		NOW
139/239	DECODER	1 of 4	DUAL BINARY: ACTIVE LOW/ACTIVE HIGH	16 DIP, SOIC		NOW Q3 '91
151/251	MULTIPLEXER	8 Input	TTL OTPT/3-STATE	16 DIP, SOIC		
153/253	MULTIPLEXER	Dual 4 Input	TTL OTPT/3-STATE	16 DIP, SOIC		NOW
157/8	MULTIPLEXER	Quad 2 Input	TTL OTPT: N-INVRT OTPT/INVRT	16 DIP, SOIC		NOW
257/8	MULTIPLEXER	Quad 2 Input	3-STATE OTPT: N-INVRT OTPT/INVRT	16 DIP, SOIC		NOW
521	COMPARATOR	8 Bit ID	LOW ACTIVE	20 DIP, SOIC ZIP, QSOP	20 ZIP, QSOP, SOIC	NOW
280	PARITY GEN/CHKR	9 Bit		14 DIP, SOIC		NOW
1280	PARITY GEN/CHKR	9 Bit		20 DIP, SOIC ZIP, QSOP		NOW

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PART NUMBER	TYPE	ORGANIZATION	FEATURES	PACKAGES A/B/C-SPEED	PACKAGES D SPEED	AVAILABILITY
COUNTERS & SHIFT REGISTERS						
161/3	COUNTER	4 Bit BINARY	ASYN CLR/CLK CLR	16 DIP, SOIC		NOW
191/3	COUNTER	4 Bit UP/DOWN	1 CLK/2 CLK, ASYN CLR	16 DIP, SOIC		NOW
299	SHIFT REGISTER	8 Bit	UNIVERSAL	20 DIP, ZIP SOIC, QSOP		Q1 '92
LATCHES						
373	LATCH	8 Bit	N-INVRT OTPT/INVRT	20 DIP, ZIP SOIC,QSOP	20 ZIP SOIC,QSOP	NOW
573	LATCH	8 Bit	N-INVRT OTPT, I/O SAME SIDE	20 DIP, ZIP SOIC,QSOP		NOW
841	LATCH	10 Bit	I/O SAME SIDE	24 DIP, ZIP SOIC,QSOP		NOW
843	LATCH	9 Bit	I/O SAME SIDE	24 DIP, ZIP SOIC,QSOP		NOW
845	LATCH	8 Bit	I/O SAME SIDE	24 DIP, ZIP SOIC,QSOP		NOW
543/4	TRANSCEIVER	8 Bit	N-INVRT OTPT/ INVRT	24 DIP, ZIP SOIC,QSOP		NOW
25-Ohm Resistor 2000 Family REGISTERS						
2273	REGISTER	8 Bit	ASYN CLR	20 DIP, ZIP SOIC,QSOP	20 DIP, ZIP SOIC,QSOP	NOW
2374/2534	REGISTER	8 Bit	N-INVRT OTPT /INVRT	20 DIP, ZIP SOIC,QSOP	20 DIP, ZIP SOIC,QSOP	NOW
2377	REGISTER	8 Bit	CLK ENABLE	20 DIP, ZIP SOIC,QSOP	20 DIP, ZIP SOIC,QSOP	NOW
2821/3/5	REGISTER	10/9/8 Bit	SAME SIDE I/O	24 DIP, ZIP SOIC,QSOP	24 ZIP SOIC,QSOP	NOW
2646/8	R-TRANSCEIVER	8 Bit	GTED OTPT EN: N-INVRT OTPT/INVRT	24 DIP, ZIP SOIC,QSOP		NOW
2651/2	R-TRANSCEIVER	8 Bit	INVRT OTPT/N-INVRT	24 DIP, ZIP SOIC,QSOP		NOW
29FCT2052/53	R-TRANSCEIVER	8 Bit	SAME SIDE I/O: N-INVRT OTPT/INVRT	24 DIP, ZIP SOIC,QSOP	24 ZIP, DIP SOIC,QSOP	NOW
29FCT20520/1	PIPELINE	4 by 8 Bit	LOAD CONTROL PARAMETERS	24 DIP, ZIP SOIC,QSOP	24 ZIP, DIP SOIC,QSOP	NOW
25-Ohm Resistor 2000 Family MSI LOGIC						
2138/2238	DECODER	1 of 8	ACTIVE LOW/ ACTIVE HIGH	16 DIP, SOIC		NOW
2139/2239	DECODER	1 of 4	DUAL BINARY: ACTIVE LOW/ ACTIVE HIGH	16 DIP, SOIC		NOW
2151/2251	MULTIPLEXER	8 Input	TTL OTPT/3-STATE	16 DIP, SOIC		NOW
2153/2253	MULTIPLEXER	Dual 4 Input	TTL OTPT/3-STATE	16 DIP, SOIC		NOW
2157/8	MULTIPLEXER	Quad 2 Input	TTL OTPT: N-INVRT OTPT/ INVRT	16 DIP, SOIC		NOW
2257/8	MULTIPLEXER	Quad 2 Input	3-STATE OTPT: N-INVRT OTPT/ INVRT	16 DIP, SOIC		NOW
2521	COMPARATOR	8 Bit ID	LOW ACTIVE	20 DIP, SOIC ZIP, QSOP		NOW
25-Ohm Resistor 2000 Family COUNTERS & SHIFT REGISTERS						
2161/3	COUNTER	4 Bit BINARY	ASYN CLR/CLK CLR	16 DIP, SOIC		Q1 '92
2191/3	COUNTER	4 Bit UP/DWN	1 CLK/2 CLK ASYN CLR	16 DIP, SOIC		Q1 '92
2299	SHIFT/REGISTER	8 Bit	UNIVERSAL	20 DIP, ZIPP SOIC,QSO		Q1 '92
25 Ohm Resistor 2000 Family BUFFERS & TRANSCEIVERS						
2240/1/4	BUFFER	8 Bit	INVRT OTPT,E=0/ N-INVRT,E2=1/ N-INVRT,E=0	20-pin DIP, ZIP SOIC,QSOP	20-pin ZIP, DIP SOIC,QSOP	NOW
2540/1	BUFFER	8 Bit	INVRT OTPT, N-INVRT I/O SAME SIDE	20-pin DIP, ZIP SOIC,QSOP	20-pin ZIP, DIP SOIC,QSOP	NOW
2827/8	BUFFER	10 Bit	N-INVRT OTPT/ INVRT	24-pin DIP, ZIP SOIC,QSOP	24-pin ZIP, DIP SOIC,QSOP	NOW
2245	TRANSCEIVER	8 Bit	N-INVRT OTPT	20-pin DIP, ZIP SOIC,QSOP	20-pin ZIP, DIP SOIC,QSOP	NOW
2861/2	TRANSCEIVERS	10 Bit	N-INVRT/INVRT OER=0 OET=0	24-pin DIP, ZIP SOIC,QSOP	24 -pin ZIP, DIP SOIC,QSOP	NOW
2863/4	TRANSCEIVERS	9 Bit	N-INVRT/INVRT OER1,2=0 OET1,2=0	24-pin DIP, ZIP SOIC,QSOP	24-pin ZIP, DIP SOIC,QSOP	NOW
25 Ohm Resistor 2000 Family BUFFERS & TRANSCEIVERS						
2240/1/4	BUFFER	8 Bit	INVRT OTPT,E=0/ N-INVRT,E2=1/ N-INVRT,E=0	20-pin DIP, ZIP SOIC,QSOP	20-pin DIP, ZIP SOIC,QSOP	NOW
2540/1	BUFFER	8 Bit	INVRT OTPT, N-INVRT I/O SAME SIDE	20-pin DIP, ZIP SOIC,QSOP	20-pin DIP, ZIP SOIC,QSOP	NOW
2827/8	BUFFER	10 Bit INVRT	N-INVRT OTPT/ SOIC,QSOP	24-pin DIP, ZIP SOIC,QSOP	24-pin ZIP	NOW
2245	TRANSCEIVER	8 Bit	N-INVRT OTPT	20-pin DIP, ZIP SOIC,QSOP	20-pin ZIP, DIP SOIC,QSOP	NOW
2861/2	TRANSCEIVERS	10 Bit	N-INVRT/INVRT OER=0 OET=0	24-pin DIP, ZIP SOIC,QSOP	24 -pin ZIP, DIP SOIC,QSOP	NOW
2863/4	TRANSCEIVERS	9 Bit	N-INVRT/INVRT OER1,2=0, OET1,2=0	24-pin DIP, ZIP SOIC,QSOP	24-pin ZIP, DIP SOIC,QSOP	NOW

Quality Semiconductor

Some things are just built to last longer.

It's true. Military systems which are very much alive and doing very well rely heavily on the use of electronic components which are no longer being made. Just when the military's usage of such products reaches maturity, it is being obsoleted by the manufacturer in favor of new technology. You can't just go anywhere to find discontinued devices. Cost, delivery, reliability, and service are necessary considerations. What is the answer? Rochester Electronics.

With over 200 million devices in stock, including dice and original mask sets, Rochester claims to be the world's largest supplier of obsolete semiconductors. In addition to it's role as leading distributor, Rochester is also a manufacturer, enabling a continuing and reliable source for obsolete devices. With a quality system designed to meet MIL-I-45208, all product is fully guaranteed and purchased direct from **AMD, Harris, Intel, Motorola, National/Fairchild, and Texas Instruments.**

With all that's going on in the world today, it's nice to know you can rely on someone when "the chips are down." You can rely on Rochester Electronics.

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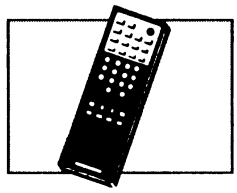
ROHM CORPORATION
ROHM Electronics Division
3034 Owen Drive, Antioch, TN 37013
Telephone (615) 641-2020 • FAX (615) 641-2022

Application Specific Microcontrollers

SRAMICS

Series BU2403L/BU2404L

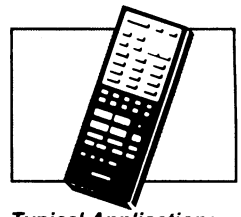
- 8-bit parallel output
- 4-bit parallel input
- Carrier output
- Delay timer
- Watchdog timer



Typical Application:
Basic 32 key remote control

Series BU2430L/BU2431L

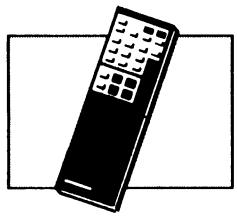
- 8-bit parallel output
- 4-bit parallel input
- 2-bit parallel I/O port
- Carrier output
- Watchdog timer



Typical Application:
Basic 48 key remote control

Series BU2428L/BU2429L

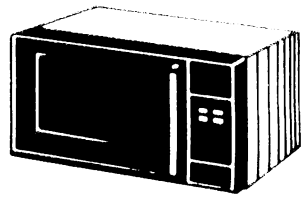
- 6-bit parallel output
- 4-bit parallel input
- Carrier output
- Delay timer
- Watchdog timer



Typical Application:
Basic 24 key remote control

Series BU2421/BU2425

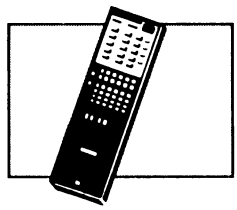
- 4-bit parallel input
- 4-bit parallel I/O port
- Buzzer output
- Timer counter
- LED controller/driver (3x8)
- Watchdog timer
- A/D converter (8-bit x 2-channel)/ comparator (2-channel)



Typical Application:
Kitchen appliance with display; NiCad battery charger

Series BU2418L/BU2419L/BU2422L

- 8-bit parallel output
- 4-bit parallel input
- 4-bit parallel I/O port
- Carrier output
- Watchdog timer



Typical Application:
Basic 64 key remote control

Rohm

Series	ROM 8-bit	RAM 4-bit	Ports I	Ports O	Ports I/O	Instruction Set	Stack	EXE Time (μs)	V_{DD} (V)	I_{DD} (mA)	Package	Support System
BU2403L BU2404L	640	16	4	8	-	40	2	12.5	3.0	0.3	MF18 DIP18	RDSBU2 EV2403C
BU2428L BU2429L	640	16	-	-	-	40	2	12.5	3.0	0.3	MF16 DIP16	RDSBU2 EV2403C
BU2418L BU2419L BU2422L	1024	32	4	8	4	43	3	12.5	3.0	0.3	MF22 DIP22 SDIP22	RDSBU2 EV2418
BU2430L BU2431L	1024	32	-	-	-	43	3	12.5	3.0	0.3	MF20 DIP20	RDSBU2 EV2418
BU2421 BU2425	1024	64	4	1	4	38	3	1.5	5.0	0.5	SDIP32 QFP32	RDSBU2 EV2421

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3034 Owen Drive, Antioch, TN 37013
Telephone (615) 641-2020 • FAX (615) 641-2022

RAMICS-4

RAMICS-4 µPs rival the functionality of many 8-bit microcontrollers by generating in a 4-bit format the design's required functions with minimum silicon redundancy. The series offers an unusual degree of architectural flexibility, plus rapid concept-to-production turnaround.

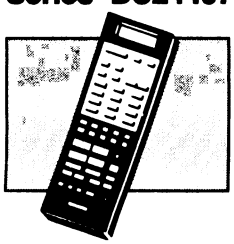
The architecture is built around a CPU core and a series of RAM-mapped I/O blocks. The user may develop the hardware around a chosen CPU in core. This helps to optimize the hardware in a very short time.

Instruction execution times range from 6 to 1.5 µsec. Most instructions are executable in one cycle.

A 100 instruction set allows for efficient, yet powerful, software control. Both external and internal interrupts are supported.

The base chip offers a group of features that meet many needs, including ROM ranging in size from 2K to 8K 8-bit bytes and RAM from 128 to 512 4-bit nibbles. The functional I/O library block includes serial and parallel I/Os, LCD controller/drivers and LED drivers, timers, timer/counters, high-current carrier generator output ports, watchdog timers, A/D, D/A converters in a variety of configurations, pulse-width modulators and TV on-screen display blocks.

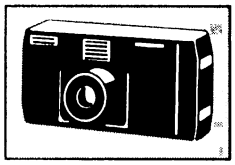
Series BU24407L/BU24808L



- Parallel I/O ports: two 4-bit, one 2-bit
- Timer/counter
- Carrier generator
- Two 4-bit STOP control inputs
- Dual clock

Typical Application:
48-Key LCD Remote Control

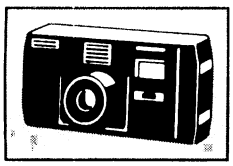
Series BU24410L/BU24809L



Typical Application:
Camera

- Four 4-bit parallel I/O ports
- LCD controller/driver (4x36)
- Carrier generator
- 8-bit serial I/O
- Dual clock
- Two 4-bit STOP control inputs
- Clock timer
- Watchdog timer

Series BU24805L



Typical Application:
Camera

- Five 4-bit parallel I/O ports
- 4-bit parallel input
- LCD controller/driver (3x8)
- Two 4-bit LED parallel outputs
- 8-bit serial I/O port
- Two 4-bit STOP control inputs
- 8-bit 8-channel A/D converter
- Two 8-bit 2-channel timer/counters
- Dual clock
- Clock timer
- Watchdog timer

Series BU24204/BU24416

Typical Application:
Audio Spectrum Analyzer

- Two 4-bit I/O ports
- One Serial 8-bit I/O
- LCD Controller/Driver (4 x 24)
- Clock
- Timer/counter
- 8-bit 4-channel A/D
- STOP Control
- Clock timer
- Watchdog timer

Series	ROM 8-bit	RAM 4-bit	Instruction Set	Stack	INT I	INT O	EXE Time (µs)	V_{DD} (V)	I_{DD} (mA)	Package	Support System
BU24407L BU24808L	4096 8192	128	100	8	2	2	6.0	3.0	1.0	QFP64	RAMICS-4/ICE
BU24410L BU24809L	4096 8192	256	100	8	2	2	6.0	3.0	2.0	SQFP80	RAMICS-4/ICE
BU24805L	8192	256	100	8	4	0	6.0	3.0	2.0	SQFP80	RAMICS-4/ICE
BU24204 BU24416	2K 4K	128	100	8	3	1	1.5	5.0	5.0	QFP64	RAMICS-4/ICE

Dual Operational Amplifiers

Internally Compensated; Commercial Temperature Range (-20°C to +75°C)

BA4558

- High-speed, low noise, wide bandwidth
- Low power consumption (50 mW typ.)
- Short-circuit protected output
- Internal phase compensation

BA4560

- Offers increased performance over BA4558
- High output current capacity
- Excellent slew rate of 4V/μS
- 10 MHz gain-bandwidth product

BA15532

- Low noise
- High output current capacity
- High slew rate
- Pin-compatible with Signetics NE5532

BA15218

- Low noise
- Internal phase compensation
- Low distortion
- Operate on either single or dual power supply

BA10358

- Wide supply voltage range: 3 - 30V
- Can operate on single power supply
- Low current consumption
- Level compatible with any type of logic device

Device	V_{IO} mV MAX	I_{IO} nA MAX	I_B nA MAX	SVR mV/V MAX	I_O mA MAX
BA4558*	6 0	200	500	150	6 0
BA4560*	±6 0	±200	±500	150	—
BA15532*	4 0	300	1500	100	8 0
BA15218*	5 0	200	500	—	8 0
BA10358*	4 0	300	1500	—	1 2

*Surface Mount and Single Inline Packages Available

Rohm

Quad Operational Amplifier

Internally Compensated; Extended Temperature Range (-40°C to +85°C)

BA14741A

- Can operate on single or dual power supply
- Internal phase compensation
- Broad supply voltage range (±2 to ±18 V)

Device	V_{IO} mV TYP	I_{IO} nA TYP	I_B nA TYP	AV V/mV TYP	CMR dB TYP	SVR dB TYP	V_{ICM} V/m TYP	VN Vrms TYP	SR V/μS TYP	SEP dB TYP	I_O mA TYP
BA14741A*	1 0	10	60	100	100	100	±13 5	2 0	1 0	100	3 0

*Surface Mount Packages Available

Quad Comparator

Commercial Temperature Range (-20°C to +75°C)

BA10339

- Wide supply voltage range: 2 to 36 V
- Can operate on single or dual power supply
- Open collector outputs allow wired OR output connections

Dual Comparator

Commercial Temperature Range (-20°C to +75°C)

BA10393

- Wide supply voltage range: 2 to 30 V
- Can operate on single or dual power supply
- Open collector outputs allow wired OR output connections

Device	V_{IO} mV MAX	I_{IO} nA MAX	I_B nA MAX	V_{ICM} V MAX	V_{OSAT} mV MAX	I_O mA MAX
BA10339*	±5 0	±50	250	Vcc 1 5	400	1 0
BA10393	±5 0	±50	250	Vcc 1 5	400	1 0

*Surface Mount Packages Available

Audio/Video Switches for Every Application

ROHM offers the industry's widest array of A/V switch ICs. Excellent performance characteristics such as flat frequency response from 1 MHz to 10 MHz, wide dynamic range and low crosstalk make these the switches of choice for the most demanding applications.

Video Signals

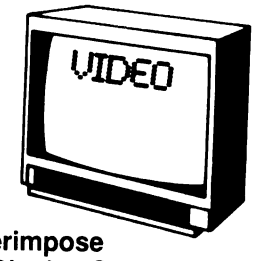
Type	Package	No. Pins	Switch		Clamp	6dB Amp	75Ω Driver	Mute	Supply Voltage (V)
BA7001	SIP	8	2 Inputs	1 Circuit					8 to 13
BA7131F	SOP	8			○			○	5
BA7605N	SIP	10		2 Circuits	○			○	5
BA7603/F	DIP/SOP	16/16		3 Circuits	○				5
BA7606/F	DIP/SOP	16/16			○				5
BA7021	SIP	9	3 Inputs	1 Circuit	○			○	5
BA7611N	SIP	8			○	○			5
BA7611AN	SIP	8			○	○		○	4.5 to 13
BA7613N	SIP	8			○	○	○	○	4.5 to 13
BA7612N	SIP	8				○	○	○	4.5 to 13
BA7645N	SIP	10	4 Inputs		○			○	4.5 to 13
BA7649A	DIP	14	5 Inputs		○				4.5 to 13
BA7625	DIP	16	5 Inputs, 2 output and 5 inputs,1 output for monitor		○	○			5
BA7626	DIP	16				○			5

Audio Signals

Type	Package	No. Pins	Switch		Simul cast	Second Audio Program	Mute	Supply Voltage (V)
BA3128N/F	SIP/SOP	8/8	2 Inputs	1 Circuit				5 to 32
BA7057S	SDIP	22	HiFi VCR audio input selector 4 lines 8 inputs, 2 lines 4 outputs		○			7 to 13
BH7733S	SDIP	24	HiFi VCR audio input selector 6 lines 10 inputs, 2 lines 4 outputs		○	○	○	9 ±5
BA7056LS	SZIP	24	HiFi VCR audio output selector 2 lines 3 inputs, 2 lines 4 outputs				○	7 to 13
BA7730S /31S	SDIP	32	HiFi VCR audio I/O selector Input side 3 lines 5 inputs, 2 lines 4 outputs Ouptut side 2 lines 4 inputs, 2 lines 4 outputs		○	○	○	7 to 13

Video & Audio Signals

Type	Package	No. Pins	Switch		Clamp	6dB Amp	75Ω Driver	Mute	Supply Voltage (V)
BA7604N	SIP	10	2 Inputs	2 Circuits					5
BA7608N	SIP	10			1 Circuit				5
BA7609/F	DIP/SOP	16/16		3 Circuits	1 Circuit				5
BA7607/F	DIP/SOP	16/16			2 Circuits				5
BA7602/F	DIP/SOP	16/16							5
BA7644AN	SIP	10	4 Inputs	1 Circuit				○	4.5 to 13



Color / Superimpose On-Screen Display Controller

For applications such as satellite receivers, cable TV converters and VCRs, ROHM now offers the BU5963AS chip for generation and on-screen display of alphanumeric characters and backgrounds.

Characters may be displayed in any of eight different colors. They can be superimposed in color onto composite video signals or contrasted against solid-color backgrounds, which also are available in eight colors.

Up to 128 unique 12x18 alphanumeric characters may be generated in NTSC format. A total of 240 characters may be displayed at once, in 10 lines of 24 characters each.

The BU5963AS features a built-in sync separator which separates the sync from composite video signals. This circuit includes a 3.58 MHz oscillator to generate input when needed. Thus even when signal levels are weak, the device will continue to display generated characters without a horizontal sync.

In addition, a built-in automatic frequency control (AFC) circuit holds characters steady in the event of a shaky video signal. Built-in SYNC SEP and AFC circuits eliminate the need for several external devices, and reduce manual set-up time required for adjustment of coils and trimmer capacitors.

An internal automatic phase control (APC) circuit locks together the color burst phase of the video signal with the internally-generated character signal. Thus it is possible to display characters in eight different colors when they are superimposed onto composite video.

Rohm

Scorpion SEMICONDUCTOR

MOS NON-VOLATILE AND SERIAL MEMORY SELECTION GUIDE E-PROMs/SHIFT REGISTERS/FIFOs

Shift Registers

Part Number	Capacity/ Organization	Mode	Speed (MHz)	Supply Voltages	Clock Phases	TTL Clocks	Recirc Logic	Pins	Output
AM2802	Quad 256	Dynamic	10	+5,-5	Two	No	No	16	Single-ended
AM2803	Dual 512	Dynamic	10	+5,-5	Two	No	No	8	Single-ended
AM2804	Single 1024	Dynamic	10	+5,-5	Two	No	No	8	Single-ended
AM2833	Single 1024	Static	2	+5,-5	One	Yes	Yes	8	Push-pull
AM2847	Quad 80	Static	3	+5,-5	One	Yes	Yes	16	Push-pull
AM2855	Quad 128	Static	2.5	+5,-5	One	Yes	Yes	16	Push-pull
AM2856	Dual 256	Static	2.5	+5,-5	One	Yes	Yes	10	Push-pull
AM2857	Single 512	Static	2.5	+5,-5	One	Yes	Yes	8	Push-pull

First-In First-Out Memories

Part Number	Organization	Serial I/O	Fullness Flag	Output Enable	Package Pins	Data Rate MHz	Temp. Range
AM2812	32 x 8	Yes	Yes	Yes	28	0.5	C,E*
AM2812A	32 x 8	Yes	Yes	Yes	28	1.0	C,E
AM2813	32 x 8	No	Yes	Yes	28	0.5	C,E
AM2813A	32 x 8	No	Yes	Yes	28	1.0	C,E
AM2841	64 x 4	No	No	No	16	1.0	C,E
AM2841A	64 x 4	No	No	No	16	1.2	C

*E is extended temperature range, -55°C to 85°C.

U.V. Erasable Proms

Part Number	Organization	Access Time (ns)	Temp. Range	Oper. Power Act/Stby Max (mW)	Supply Voltages	Outputs	Number Of Pins
AM1702A	256 x 8	1000	C,E	676	-9,+5	3-State	24
AM1702AL	256 x 8	1000	C,E	-	-9,+5	3-State	24
AM1702A-1	256 x 8	550	C,E	676	-9,+5	3-State	24
AM1702AL-1	256 x 8	550	C,E	-	-9,+5	3-State	24
AM1702A-2	256 x 8	650	C,E	676	-9,+5	3-State	24
AM1702AL-2	256 x 8	650	C,E	-	-9,+5	3-State	24

Scorpion Semiconductor,
2360 Qume Drive, Suite B, San Jose, CA 95131 408-944-6270 Fax: 408-944-6272

SII
Seiko Instruments

Seiko Instruments USA Inc.
Semiconductor Products Group
1150 Ringwood Court
San Jose, CA 95131 U.S.A.
Phone: 408-433-3208
Facsimile: 408-433-3214

Memory Products

NV RAMs

Features
- 5-V single power supply. Electrically erasable and programmable ROM
- Three-state outputs
- Store and recall are controlled by a narrow signal width : >200ns (parallel type)
- 10,000 or 100,000 erase/write cycles for EPROM
- Ten-year data retention
- Erroneous store protection: =3.5V
- Wide operating temperature (I type) -40°Cto +85°C

Applications
- Contants setting
- Data memory
- Rewritable programs and firm ware
- System configuration setting
- System parameter and part No. setting
- Systems status monitor

■ SPECIFICATIONS

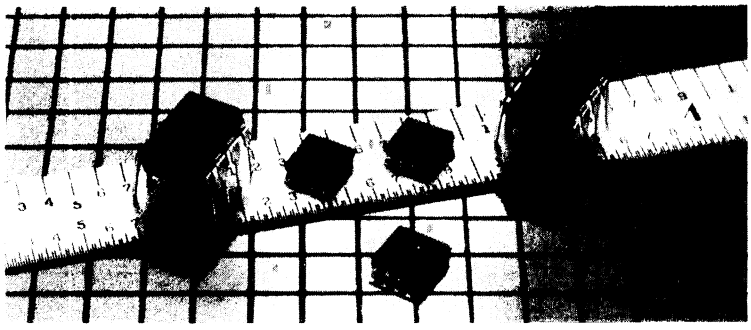
Model No.	Memory size (bit)	Composition	Operating voltage (V)	Current consumption		Static RAM operation			Store operation (ms)	Array recall operation (ns)	Package
				Operating (mA) Max.	Standby (μA) Max.	Clock frequency (Hz) Max.	Read cycle time (ns) Min.	Write cycle time (ns) Min.	Store time Max.	Recall cycle time Min.	
S-24H30R/I	64	8×8 Serial	5±10%	10	1	1M	–	–	10	2500	8 DIP/SOP
S-24S30R/I	64	8×8 Serial	5±10%	10	1	1M	–	–	10	2500	8 DIP/SOP
S-24H45R/I	256	16×16 Serial	5±10%	10	1	1M	–	–	10	2500	8 DIP/SOP
S-24S45R/I	256	16×16 Serial	5±10%	10	1	1M	–	–	10	2500	8 DIP/SOP
S-22H10R/I	256	64×4 Parallel	5±10%	20/30*1	1	–	200	200	10	1300	18 DIP/SOP
S-22S10R/I	256	64×4 Parallel	5±10%	20/30*3	1	–	200	200	10	1300	18 DIP/SOP
S-22H12R/I	1K	256×4 Parallel	5±10%	20/30*2	1	–	200	200	10	1300	18 DIP/SOP
S-22S12R/I	1K	256×4 Parallel	5±10%	20/30*4	1	–	200	200	10	1300	18 DIP/SOP

Note) H type All inputs/outputs are compatible with TTL, and can be connected directly to TTL.
S type Schmitt inputs are available to store and recall terminals.

*1 S-22H10R : 20, S-22H10I : 30 *2 S-22H12R : 20, S-22H12I : 30
*3 S-22S10R : 20, S-22S10I : 30 *4 S-22S12R : 20, S-22S12I : 30

EEPROMs

Features
- ☐ Low current consumption
- ☐ 5-V single power supply
- ☐ Write operation with built-in timer
- ☐ Data retention: 10 years
- ☐ Memory protection (S-2918, S-2961)



NEW PRODUCTS:

HIGH SPEED CMOS LOGIC ("FCT-T")
(Available Now)
- Equivalent to Quality Semiconductor's QSOP products.
- Functionally compatible to 74F series and 74FCTseries.
- < 7.5 mw power consumption.* TTL compatible inputs and outputs.* 150 mils x 340 mils surface mount pkg..
- 25 mils pin spacing.

FLASH EEPROM (Available 3/92)
- 512K (64k x 8)

SRAM (70 ns)
- 256K (32K x 8) (Available March '92
- 1M (128K x 8) (Available 2nd 1/2 '92)=

S-812XXPG SERIES - HIGH PRECISION VOLTAGE REGULATORS (Available 3/92)
- +/- 2.4% regulation.* 1.0 μA power consumption
- 1 volt I/O difference * 40 ma output current maximum
- Available in .1 volt steps from 1.1 to 6.0 volts.

■ SPECIFICATIONS

Model No.	Memory size (bit)	Composition	Operating voltage(V)		Current consumption		Clock frequency (MHz) Max.	Address access time (ns) Max.	Package	Note
			Read Min.	Write Min.	Operating (mA) Max.	Standby (μA) Max.				
S-2913AR/I	1K	64×16 Serial	1.8	2.7	2.0	1.0	2.0	–	8 DIP/SOP	NS code, sequential
S-2913CR/I	1K	32×16+32×16 Serial	1.8	2.7	2.0	1.0	2.0	–	8 DIP/SOP	NS code, sequential, Memory protection
S-2914AR/I	1K	64×16 Serial	1.8	2.7	2.0	1.0	2.0	–	8 DIP/SOP	NS code, Compatible with NMC93C46(DIP)
S-2914AID	1K	64×16 Serial	1.8	2.7	2.0	1.0	2.0	–	8 SOP	NS code, Compatible with NMC93C46
S-2919AR/I	1K	64×16 Serial	1.8	2.7	2.0	1.0	2.0	–	8 DIP/SOP	Easy interface with serial port
S-2919CR/I	1K	32×16+32×16 Serial	1.8	2.7	2.0	1.0	2.0	–	8 DIP/SOP	Easy interface with serial port, Memory protection
S-2919GR/I	1K	32×16+32×16 Serial	1.8	2.7	2.0	1.0	2.0	–	8 DIP/SOP	Easy interface with serial port, Memory protection, CS active "L"
S-2922AR/I	2K	128×16 Serial	1.8	2.7	2.0	1.0	2.0	–	8 DIP/SOP	NS code, sequential
S-2923CR/I	2K	64×16+64×16 Serial	1.8	2.7	2.0	1.0	2.0	–	8 DIP/SOP	Conform to NS code, sequential, Memory protection
S-2924AR/I	2K	128×16 Serial	1.8	2.7	2.0	1.0	2.0	–	8 DIP/SOP	Conform to NS code
S-2929AR/I	2K	128×16 Serial	1.8	2.7	2.0	1.0	2.0	–	8 DIP/SOP	Easy interface with serial port
S-2929CR/I	2K	64×16+64×16 Serial	1.8	2.7	2.0	1.0	2.0	–	8 DIP/SOP	Easy interface with serial port, Memory protection
S-2929GR/I	2K	64×16+64×16 Serial	1.8	2.7	2.0	1.0	2.0	–	8 DIP/SOP	Easy interface with serial port, Memory protection, CS active "L"
S-2933CR/I	4K	128×16+128×16 Serial	1.8	2.7	2.0	1.0	2.0	–	8 DIP/SOP	NS code, sequential, Memory protection
S-2934AR/I	4K	256×16 Serial	1.8	2.7	2.0	1.0	2.0	–	8 DIP/SOP	NS code, compatible with NMC93C66(DIP)
S-2939AR/I	4K	256×16 Serial	1.8	2.7	2.0	1.0	2.0	–	8 DIP/SOP	Easy interface with serial port
S-2939CR/I	4K	128×16+128×16 Serial	1.8	2.7	2.0	1.0	2.0	–	8 DIP/SOP	Easy interface with serial port, Memory protection
S-2939GR/I	4K	128×16+128×16 Serial	1.8	2.7	2.0	1.0	2.0	–	8 DIP/SOP	Easy interface with serial port, Memory protection, CS active "L"
S-2940I	128	16×8 Serial	2.7	3.8	5.0	1.0	0.15	–	8 DIP/SOP	Easy interface with serial port
S-2961I	384	39×8+9×8 Serial	2.7	3.8	5.0	1.0	0.15	–	8 DIP/SOP	Easy interface with serial port, Memory protection
S-2980I	768	768×1 Bit sequential	2.4	4.5	2.0	20	0.25	–	8 DIP/SOP	Compatible with MB8541
S-2911R/I	1K	64×16, 128×8 Serial	4.5	4.5	3.0/4.0	100	0.25	–	8 DIP	GI code, compatible with ER5911
S-2914R	1K	64×16, 128×8 Serial	4.5	4.5	3.0	100	0.25	–	8 DIP	NS code, compatible with NMC93C46
S-2917I	1K	64×16, 128×8 Serial	4.5	4.5	4.0	100	0.50	–	8 DIP/SOP	Easy interface with serial port
S-2918I	1K	32×8+96×8 Serial	4.5	4.5	4.0	100	0.50	–	8 DIP/SOP	Easy interface with serial port, Memory protection
S-2840A(R)	16K	2K×8 Parallel	4.5	4.5	25	100	–	200	24 DIP	Compatible with INTEL2816
*S-28F512R	512K	64K×8 Parallel	4.5	4.5	30	100	–	150/200	32 DIP/SOP	Compatible with INTEL28F512 (V_{PP}=12V)

*Under development

Seiko Instruments

Linear IC's

SII Seiko Instruments

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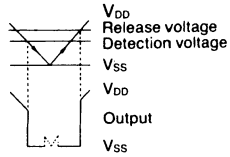
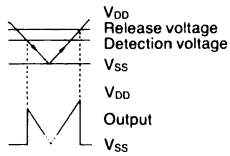
VOLTAGE DETECTORS
(S-807 SERIES)

Operation Timing Chart



Active "L"



Active "H"

Additional models/detection voltages are available– contact Seiko Instruments for details.

* The last part of the model name is changed when it is a SOT-89 package product.
S: Stick
T: Tape (T1 and T2 types are available according to the direction of detectors)

■ SELECTION GUIDE AND SPECIFICATIONS

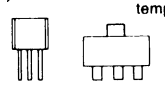
Model No.		Detection voltage (V)	Hysteresis width (V)	Output state	Current consumption (μA) Typ.	Output current (V_{DS}=0.5V) Nch Typ.		Pch Min.		Operating voltage (V)
TO-92	SOT-89*					I_{OUT} (mA)	V_{DD} (V)	I_{OUT} (mA)	V_{DD} (V)	
S-80718AL	S-80718AL-AF-X	1.8V±2.4%	0.09	CMOS output (Low)	1.4 (V_{DD}=3.0V)	0.50	1.2	0.36	4.8	1.0~15.0
S-80719AL	S-80719AL-AG-X	1.9V±2.4%	0.095							
S-80721AL	S-80721AL-AJ-X	2.1V±2.4%	0.105							
—	S-80723AL-AL-X	2.3V±2.4%	0.115							
S-80725AL	S-80725AL-AN-X	2.5V±2.4%	0.125		1.3 (V_{DD}=4.5V)	0.50	1.2	0.36	4.8	
S-80730AL	S-80730AL-AT-X	3.0V±2.4%	0.15		1.0 (V_{DD}=4.5V)	0.50	1.2	0.36	4.8	
S-80731AL	S-80731AL-AV-X	3.1V±2.4%	0.155			3.70	2.4			
S-80733AL	S-80733AL-AX-X	3.3V±2.4%	0.165							
S-80734AL	S-80734AL-AY-X	3.4V±2.4%	0.17							
S-80735AL	S-80735AL-AZ-X	3.5V±2.4%	0.175							
S-80740AL	S-80740AL-A4-X	4.0V±2.4%	0.2		1.0 (V_{DD}=6.0V)	0.50	1.2	0.46	6.0	
S-80741AL	S-80741AL-A5-X	4.1V±2.4%	0.205			3.70	2.4			
S-80745AL	S-80745AL-A9-X	4.5V±2.4%	0.225			7.00	3.6			
S-80744HL	S-80744HL-U8-X	4.295~4.605	Release voltage 4.70 max.		2.6 (V_{DD}=6.0V)	0.50	1.2	0.36	4.8	
						3.70	2.4			
—	S-80720AN-DH-X	2.0V±2.4%	0.1	Nch opendrain	1.4 (V_{DD}=3.0V)	0.50	1.2	—	—	
S-80721AN	S-80721AN-DJ-X	2.1V±2.4%	0.105		1.3 (V_{DD}=4.5V)					
S-80727AN	S-80727AN-DQ-X	2.7V±2.4%	0.135		1.0 (V_{DD}=4.5V)	0.50	1.2	—	—	
S-80728AN	S-80728AN-DR-X	2.8V±2.4%	0.14			3.70	2.4			
S-80730AN	S-80730AN-DT-X	3.0V±2.4%	0.15							
—	S-80732AN-DW-X	3.2V±2.4%	0.16							
S-80733AN	S-80733AN-DX-X	3.3V±2.4%	0.165							
S-80734AN	S-80734AN-DY-X	3.4V±2.4%	0.17							
S-80735AN	S-80735AN-DZ-X	3.5V±2.4%	0.175							
S-80740AN	S-80740AN-D4-X	4.0V±2.4%	0.2		1.0 (V_{DD}=6.0V)	0.50	1.2	—	—	
S-80741AN	S-80741AN-D5-X	4.1V±2.4%	0.205			3.70	2.4			
S-80745AN	S-80745AN-D9-X	4.5V±2.4%	0.225			7.00	3.6			
S-80740AH	S-80740AH-B4-X	4.0V±2.4%	0.2	CMOS output (High)	1.0 (V_{DD}=6.0V)	9.60	6.0	0.03	1.2	
								0.15	2.4	

VOLTAGE REGULATORS

The S-802 and S-812 Series are CMOS voltage regulators. Both Series are the fixed type which the output voltage is internally fixed. The S-802 Series is a negative voltage regulator and the S-812 is a positive voltage regulator. SOT-89 package available for surface mount.

Features
- ☐ Low current consumption
- ☐ Low input/output voltage difference
- ☐ Low temperature coefficient of output voltage (±0.38 mV/°C for the S-81230AG typ.)
- ☐ Wide operating voltage range
- ☐ Good input stability (0.1%/V typ.)

Applications
- ☐ Automobile voltage regulator
- ☐ High stability standard voltage
- ☐ Constant voltage power supply for battery-powered equipment, communications equipment, video equipment, and other equipments which require voltage temperature control



Specifications

Model No.	Output Voltage (V)	Output Current (mA) Typ.	Load Stability (mV) Typ.	Input/Output Voltage Difference (mV) Typ.	Current Consumption (μA) Typ.	Input Voltage (V) Max.	Absolute Maximum Rating (V)
S-80230AG	−3±5%	30 (V_{IN} = −5V)	60 (1_{OUT} = 1 to 20 mA)	60 (1_{OUT} = 1 mA)	2.5	−10	−12
S-80250AG	−5±5%	50 (V_{IN} = −7V)	40 (1_{OUT} = 1 to 40 mA)	30 (1_{OUT} = 1 mA)	3.0	−10	−12
S-81211AG	1.1±5%	3 (V_{IN} = 1.5V)	100 (1_{OUT} = 40 to 500 μA)	250	2.2	10	12
S-81225AG	2.5±5%	25 (V_{IN} = 4.5V)	80 (1_{OUT} = 1 to 10 mA)	100	2.5	10	12
S-81230AG	3±5%	30 (V_{IN} = 5V)	60 (1_{OUT} = 1 to 20 mA)	60 (1_{OUT} = 1 mA)	2.5	10	12
S-81250AG	5±5%	50 (V_{IN} = 7V)	40 (1_{OUT} = 1 to 40 mA)	30 (1_{OUT} = 1 mA)	3.0	10	12
S-81250HG	5±5%	50 (V_{IN} = 7V)	40 (1_{OUT} = 1 to 40 mA)	30 (1_{OUT} = 1 mA)	3.0	12	18
S-81350AG	5±5%	40 (V_{IN} = 5.2V)	80 (1_{OUT} = 1 to 60 mA)	200 (1_{OUT} = 40 mA)	25	8	10

VOLTAGE REGULATOR WITH DC-DC CONVERTER

S-8430AF is a high-precision DC-DC converter consisting of a CR oscillating circuit, a switching regulator, a series regulator and a Shottky-diode. The S-8430AF serves as a series regulator when the input voltage is higher than the output voltage. On the other hand, it serves as a step up switching regulator and as a series regulator when the input voltage is lower than the output voltage. Therefore, the output level is kept constant. The output voltage can be changed from 3V to 5V, and vice versa by an external signal. The S-8430AF is provided with a standby function that stops an internal CR oscillating circuit by other external signal.

Features
- ☐ Low current consumption
  Operating: 11μA typ.
  Standby: 0.2μA max.
- ☐ High-precision output voltage 3.0V±5%, 5.0V±4%
- ☐ Low voltage operation 0.9V min.
- ☐ Selectable output voltage (switchable from 3V to 5V, and vice versa)
- ☐ Standby function

Pin Arrangement
8-pin SOP

1. VIN
2. ON/OFF
3. SEL1
4. SEL2
5. VOUT
6. VSW
7. CONT
8. VSS

REALTIME CLOCK

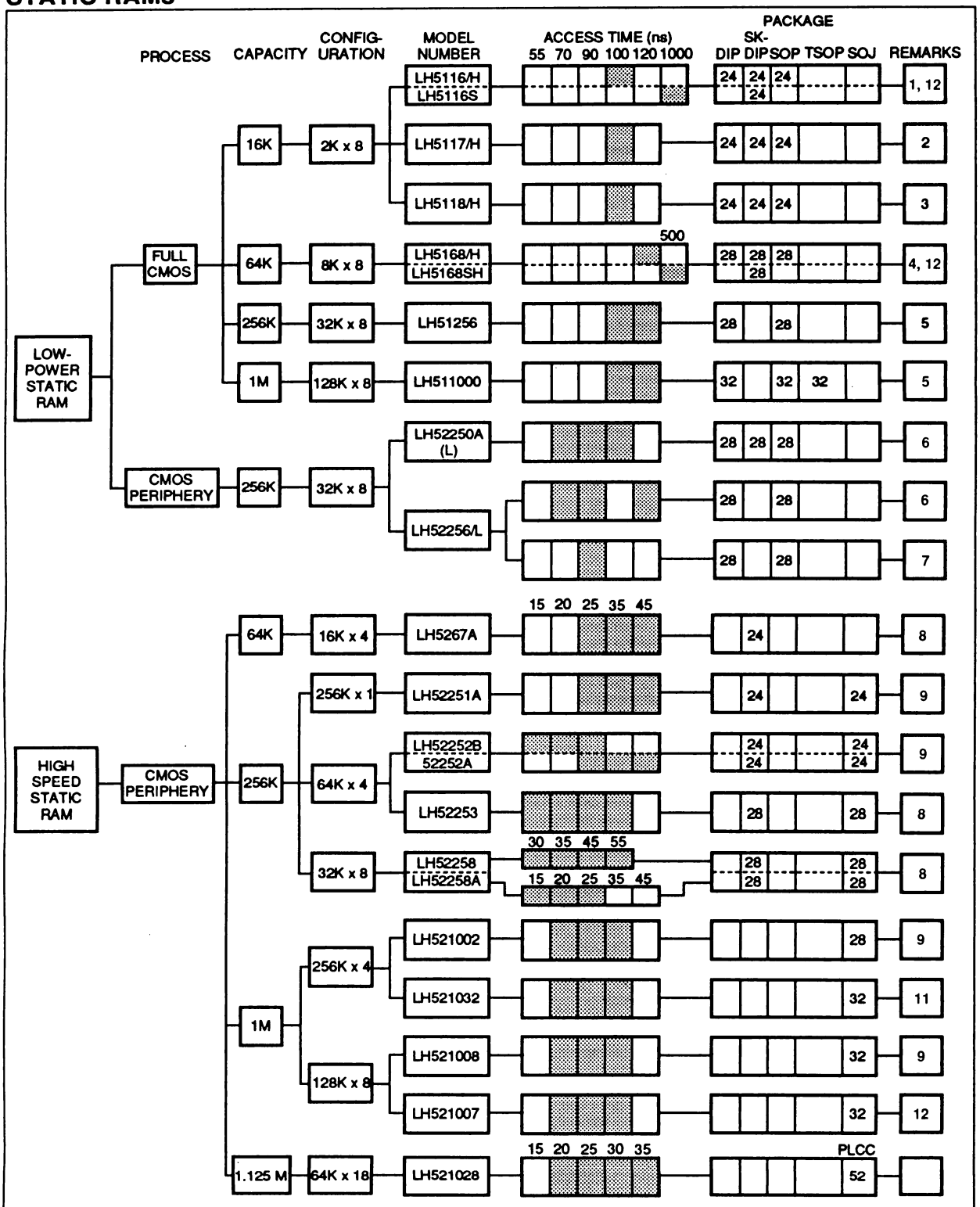
The S-3520CF is a realtime clock that inputs/outputs serial clock and calendar data into/from CPU. A built-in voltage regulator provides good frequency stability and low power consumption. Even during backup operation, the S-3520CF is effective for saving the battery service life. Because it has a built-in 120-bit SRAM, it is also useful for CPU data backup.

FEATURES
- Low Current Consumpton
- Wide data retention voltage range
- Clock and calendar data correction with the increment method
- Built-in auto-calendar until the year 2099
- Built-in 30 x 4-bit SRAM
- Easy serial interface to CPU with 5 lines

Model No.	Operating voltage range (V)	Current consumption (ΩA) Typ. V_{DD}=5.0V	Data retention voltage (V)	Oscillating frequency deviation (ppm) Deviation between ICs	Voltage deviation of oscillating frequency (ppm) V_{DD} +2.0 to 6.0V	Package
S-3520 CF	3.0 to 6.0	2.0	2.0 to 6.0	-15 to +15	-5 to +5	14 SOP

Seiko Instruments

STATIC RAMs



REMARKS:

1. $\overline{CE}$, $\overline{OE}$ control low standby 1 µA (MAX.)
2. $\overline{CE}$, $\overline{CS}$ control low standby 1 µA (MAX.)
3. $\overline{CE}_1$, $\overline{CE}_2$ control low standby 1 µA (MAX.)
4. Low standby 1 µA (MAX.)
5. Low standby 1 µA (MAX.) for L suffix type
6. Standby 100 µA (MAX.) for L suffix type
7. Standby 1 µA (3 V RT) for LL suffix type
8. $\overline{CE}$, $\overline{OE}$ control
9. $\overline{CE}$ control
10. "S" version for 3 V operation
11. Separate I/O
12. Dual CE version

NOTES:

▨ = Operating frequency or access/cycle time parts that are planned at the publication time of this data book.

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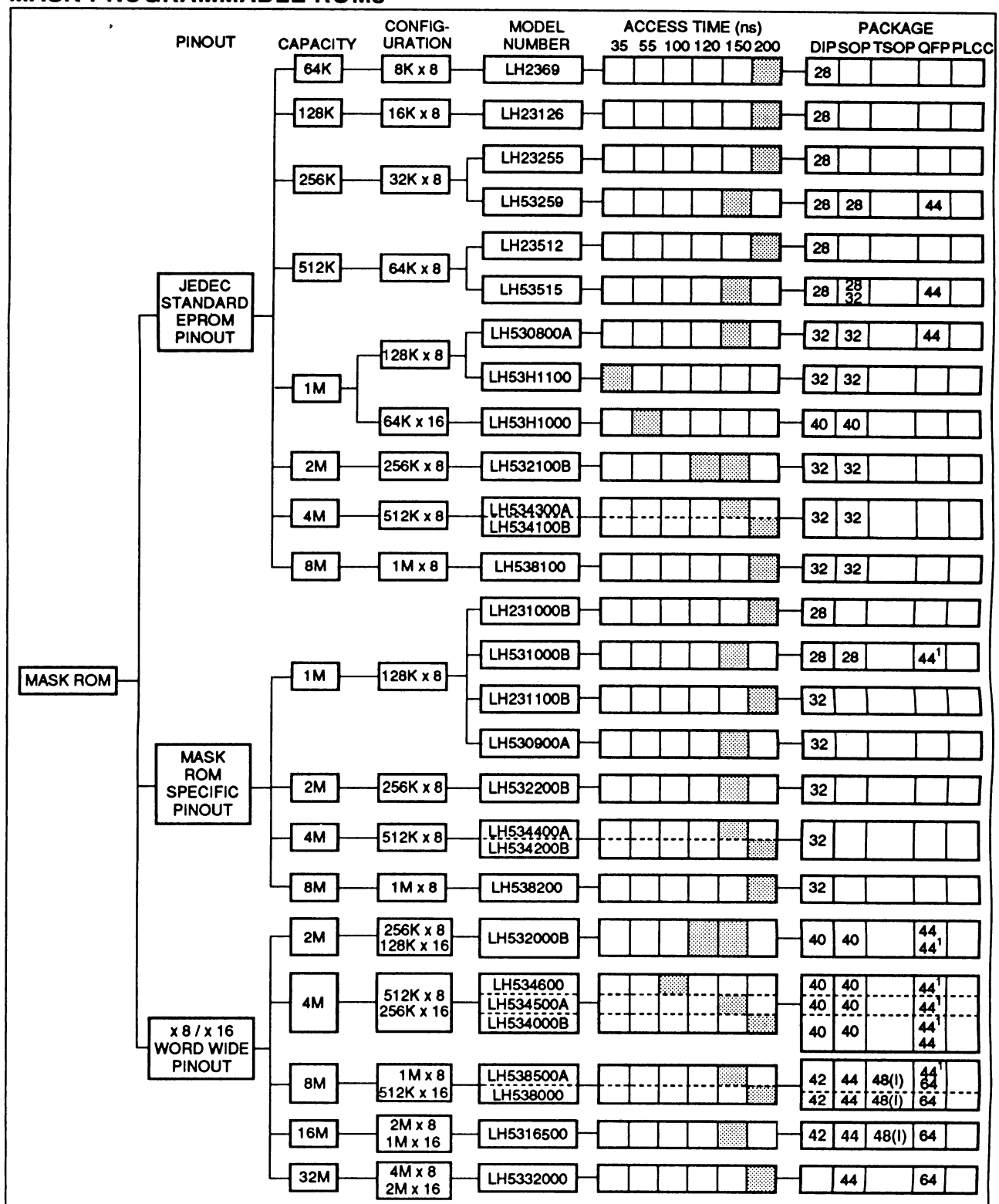
MASK PROGRAMMABLE ROMs



NOTES:

▨ = Operating frequency or access/cycle time parts that are planned at the publication time of this data book.

LH2XXX: NMOS LH5XXX: CMOS

1. 14 x 14 mm² package

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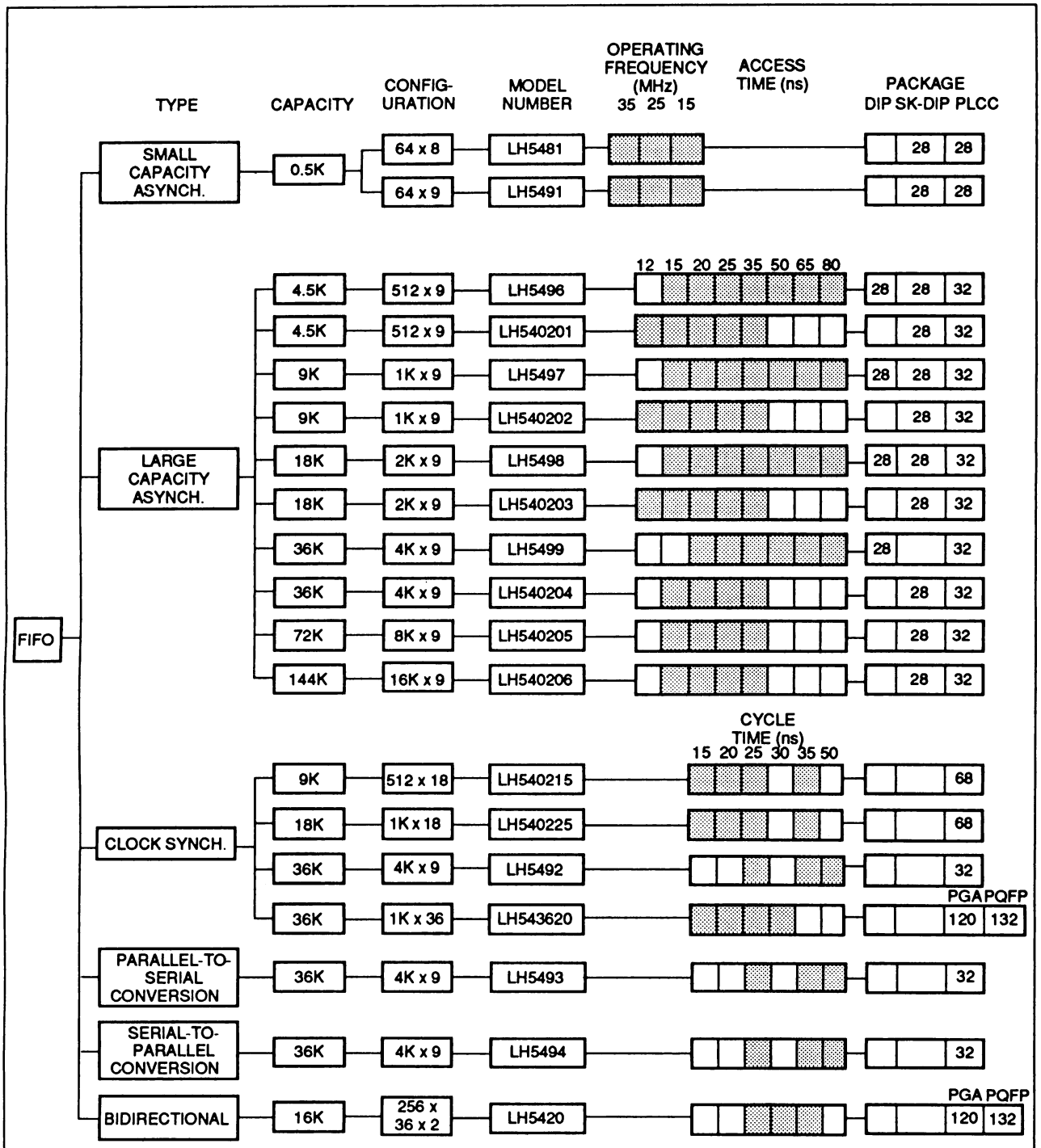

NOTES:

▨ = Operating frequency or access/cycle time parts that are planned at the publication time of this data book. Asychronous parts are specified according to access time; synchronous parts are specified according to cycle time.

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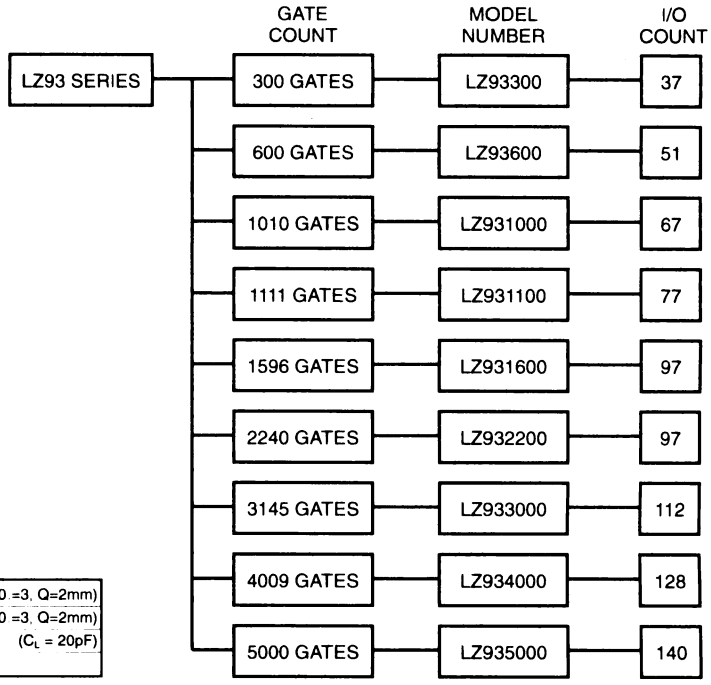
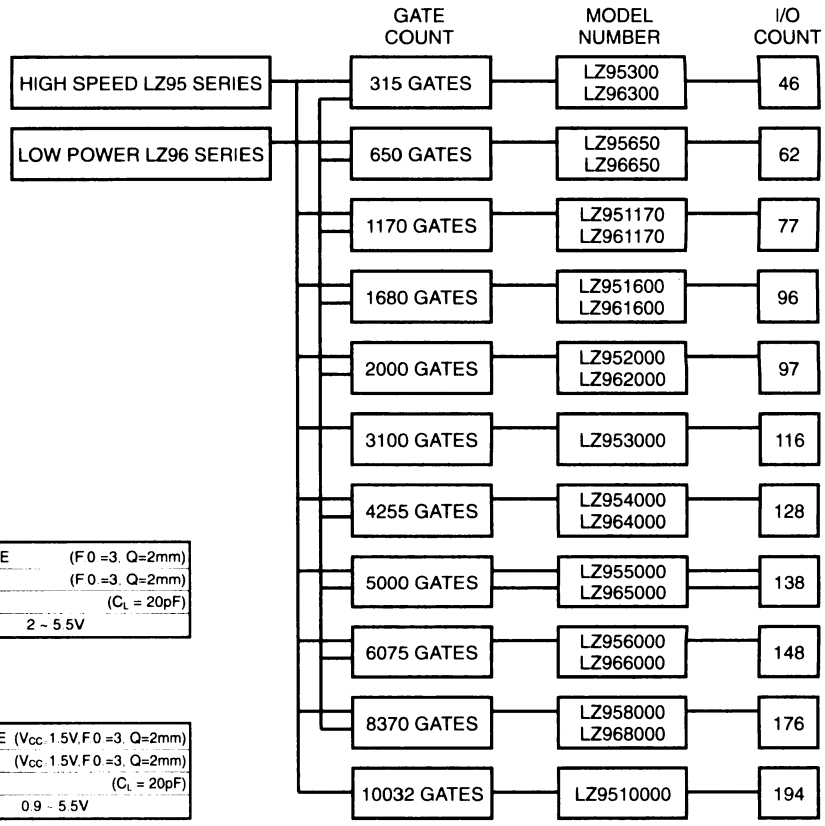
STANDARD TYPE GATE ARRAYS



DELAY TIME	INTERNAL GATE	1.7ns/GATE	(F.O.=3, Q=2mm)
	INPUT BUFFER	2.47ns	(F.O.=3, Q=2mm)
	OUTPUT BUFFER	4.2ns	(C_L = 20pF)
	SUPPLY VOLTAGE	2 ~ 5.5V	

HIGH SPEED, LOW POWER TYPES



(1) LZ95 SERIES

DELAY TIME	INTERNAL GATE	1.2ns/GATE	(F.O.=3, Q=2mm)
	INPUT BUFFER	2.4ns	(F.O.=3, Q=2mm)
	OUTPUT BUFFER	4.0ns	(C_L = 20pF)
	SUPPLY VOLTAGE	2 ~ 5.5V	

(2) LZ96 SERIES

DELAY TIME	INTERNAL GATE	9.5ns/GATE	(V_{CC} 1.5V, F.O.=3, Q=2mm)
	INPUT BUFFER	20ns	(V_{CC} 1.5V, F.O.=3, Q=2mm)
	OUTPUT BUFFER	40ns	(C_L = 20pF)
	SUPPLY VOLTAGE	0.9 ~ 5.5V	

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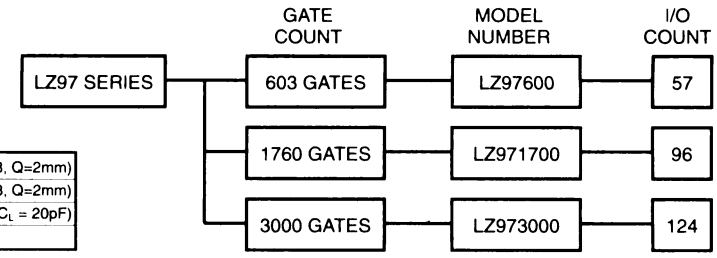
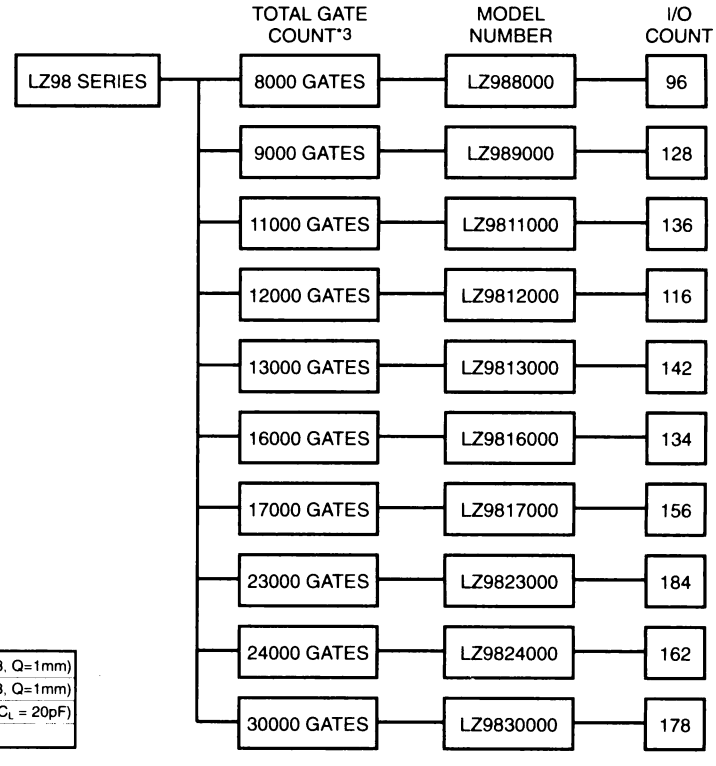
LARGE CURRENT TYPE *2



DELAY TIME	INTERNAL GATE	1.2ns/GATE	(F.O.=3, Q=2mm)
	INPUT BUFFER	2.4ns	(F.O.=3, Q=2mm)
	OUTPUT BUFFER	6.4ns	(C_L = 20pF)
	SUPPLY VOLTAGE	4.75 ~ 5.25V	

*2 Iout = 50mA MAX. (USING 2 OUTPUT BUFFERS)

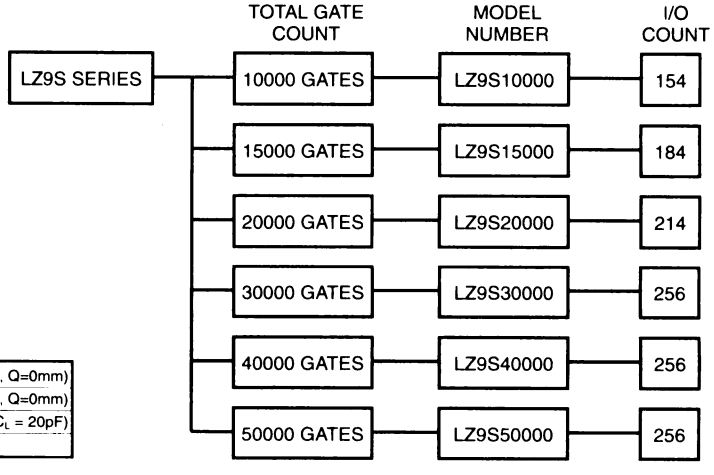
CHANNEL-FREE TYPE (SEA OF GATES)



Iout = 12mA

DELAY TIME	INTERNAL GATE	0.6ns/GATE	(F.O.=3, Q=1mm)
	INPUT BUFFER	2.6ns	(F.O.=3, Q=1mm)
	OUTPUT BUFFER	2.7ns	(C_L = 20pF)
	SUPPLY VOLTAGE	2.0 ~ 5.5V	

*3 TYPICALLY 60% UTILIZATION



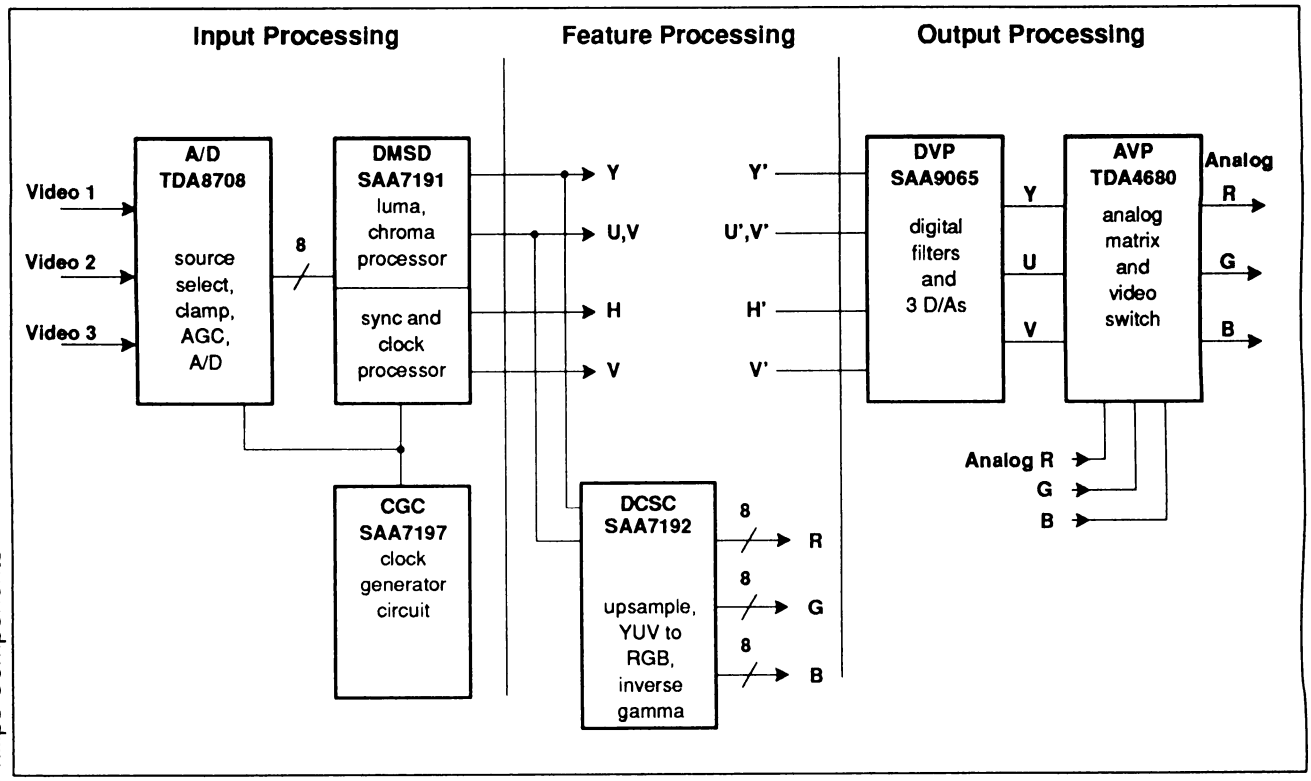
DELAY TIME	INTERNAL GATE	0.57ns/GATE	(F.O.=2, Q=0mm)
	INPUT BUFFER	0.8ns	(F.O.=2, Q=0mm)
	OUTPUT BUFFER	2ns	(C_L = 20pF)
	SUPPLY VOLTAGE	4.75 ~ 5.25V	

Desktop Video Chip Set

FEATURES

- Color video decoding
- Square pixels
  - NTSC: 12.272727MHz, 640 pixels/line
  - PAL, SECAM: 14.75MHz, 768 pixels/line
- 8 Bits Y:U:V 4:2:2
- Line-locked clock

BLOCK DIAGRAM



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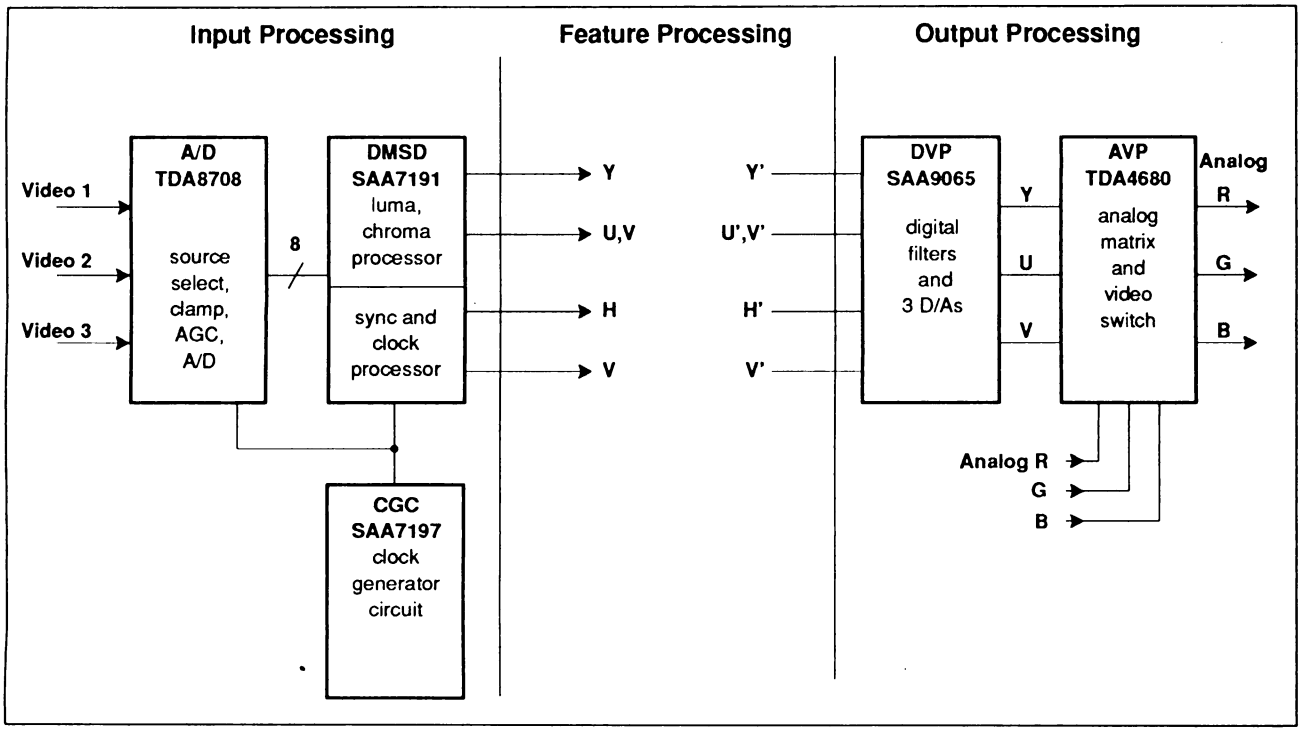
Consumer Video Chip Set

FEATURES
- Color video decoding
- 13.5MHz, 720 pixels/line
- 7 Bits Y:U:V 4:1:1
- PAL, NTSC

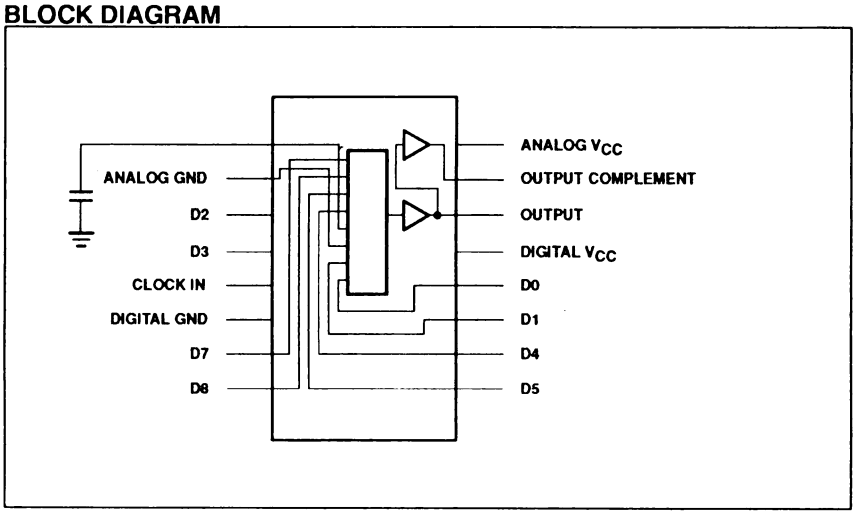
BLOCK DIAGRAM



TDA8702 – 8-Bit Digital-to-Analog Converter

FEATURES
- 30MHz
- 250mW power dissipation
- Connects in a Flash

BLOCK DIAGRAM



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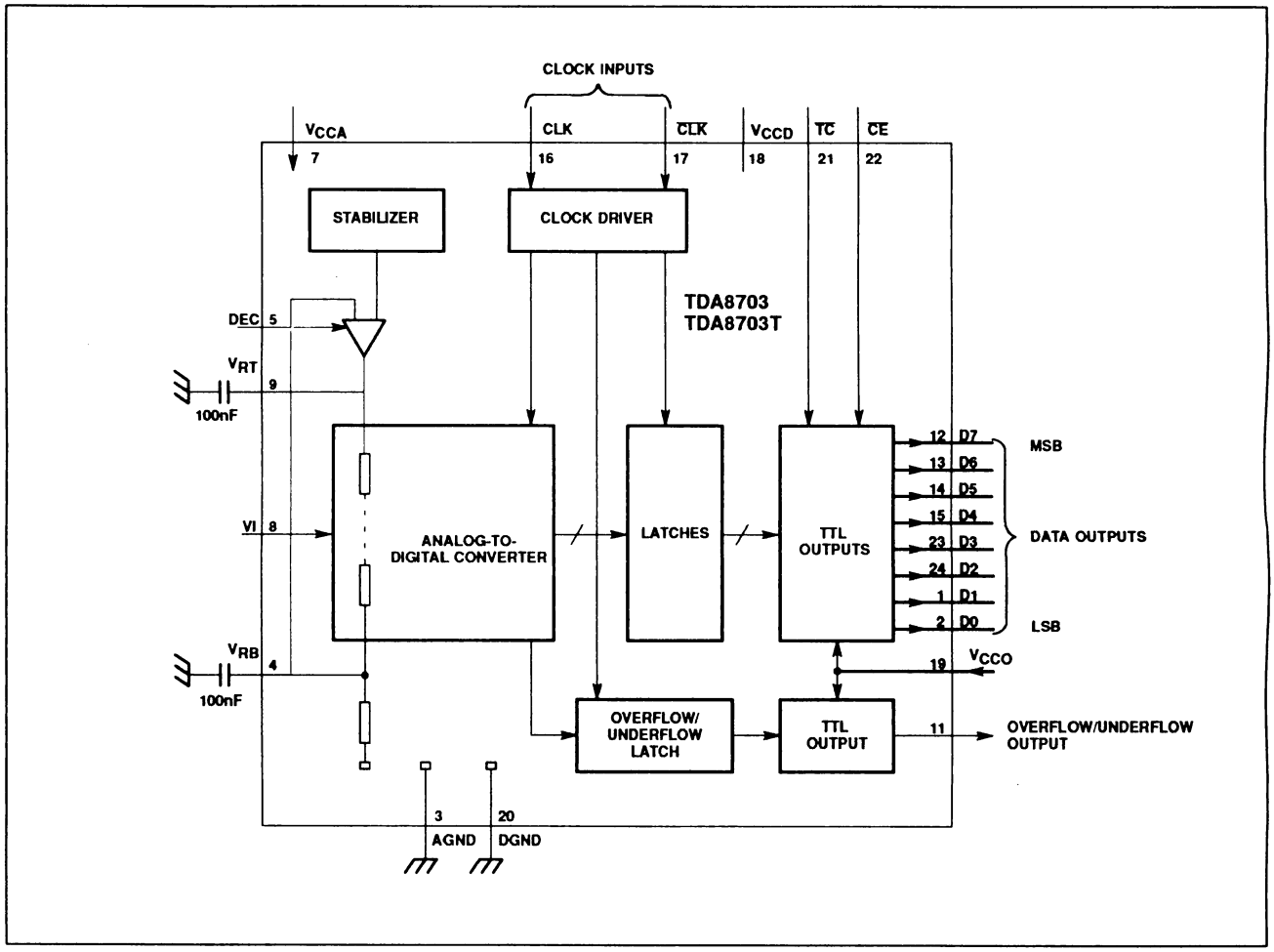
TDA8703/TDA8703T – 8-Bit High-Speed Analog-to-Digital Converter

FEATURES

- 8-bit resolution
- Sampling rate up to 40MHz
- High signal-to-noise ratio over a large analog input frequency range (7.1 effective bits at 4.43MHz full-scale input)
- Binary or two's complement 3-state TTL outputs
- Overflow/underflow 3-state TTL output
- TTL compatible digital inputs
- Low-level AC clock input signal allowed
- Internal reference voltage generator
- Power dissipation only 290mW (typical)
- Low analog input capacitance, no buffer amplifier required
- No sample and hold circuit required

BLOCK DIAGRAM



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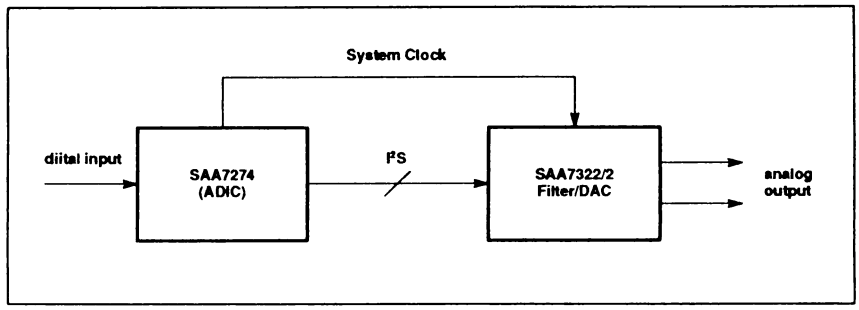
SAA7274 – Audio Digital Input Circuit (ADIC)

FEATURES

- I^2S bus output
- Biphase audio signal (Satellite radio, compact disc and DAT)
- Converts digital audio signals in accordance with the IEC/EBU standards

SYSTEM SOLUTIONS

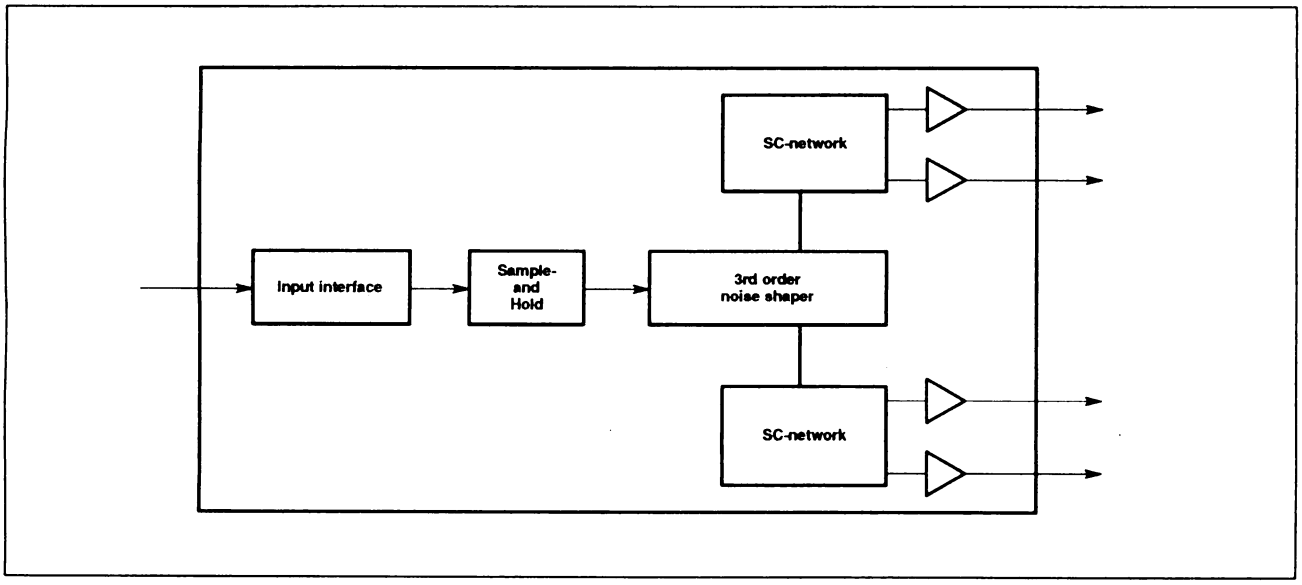


SAA7350 – 20-Bit Stereo Bitstream Digital-to-Analog Converter

FEATURES

- 20-bit resolution DAC
- 3rd order noise shaper
- Wide range of sampling rates
- Accepts variety of interface formats
- Differential mode output
- 5V single supply operation
- CMOS technology
- 44-pin quad flat pack

BLOCK DIAGRAM



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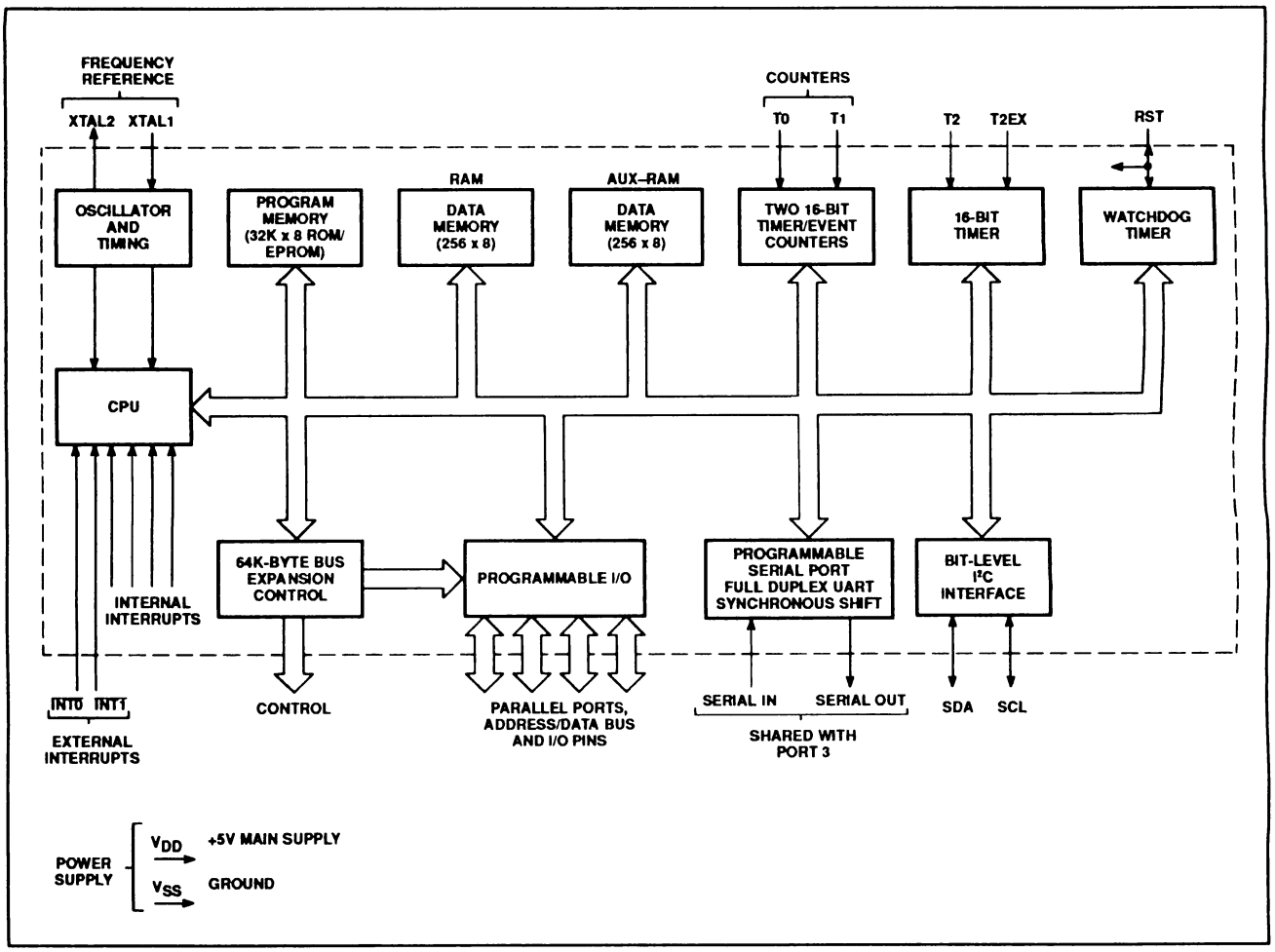
80C528/83C528/87C528 – CMOS Single-Chip 8-Bit Microcontroller

FEATURES

- 80C51 instruction set
  - 32K × 8 ROM (83C528)
  - 32K × 8 EPROM (87C528)
  - ROMless (80C528)
  - 512 × 8 RAM
  - Memory addressing capability 64K ROM and 64K RAM
  - Three 16-bit counter/timers
  - On-chip watchdog timer
  - Full duplex UART
  - I^2C serial interface
- Power control modes:
  - Idle mode
  - Power-down mode
  - Warm start from power-down
- CMOS and TTL compatible
- Speed range at V_{DD} = 5V ±10%
  - 3.5 to 16MHz
- Extended temperature ranges
- OTP package available
- ROM/EPROM code protection

BLOCK DIAGRAM



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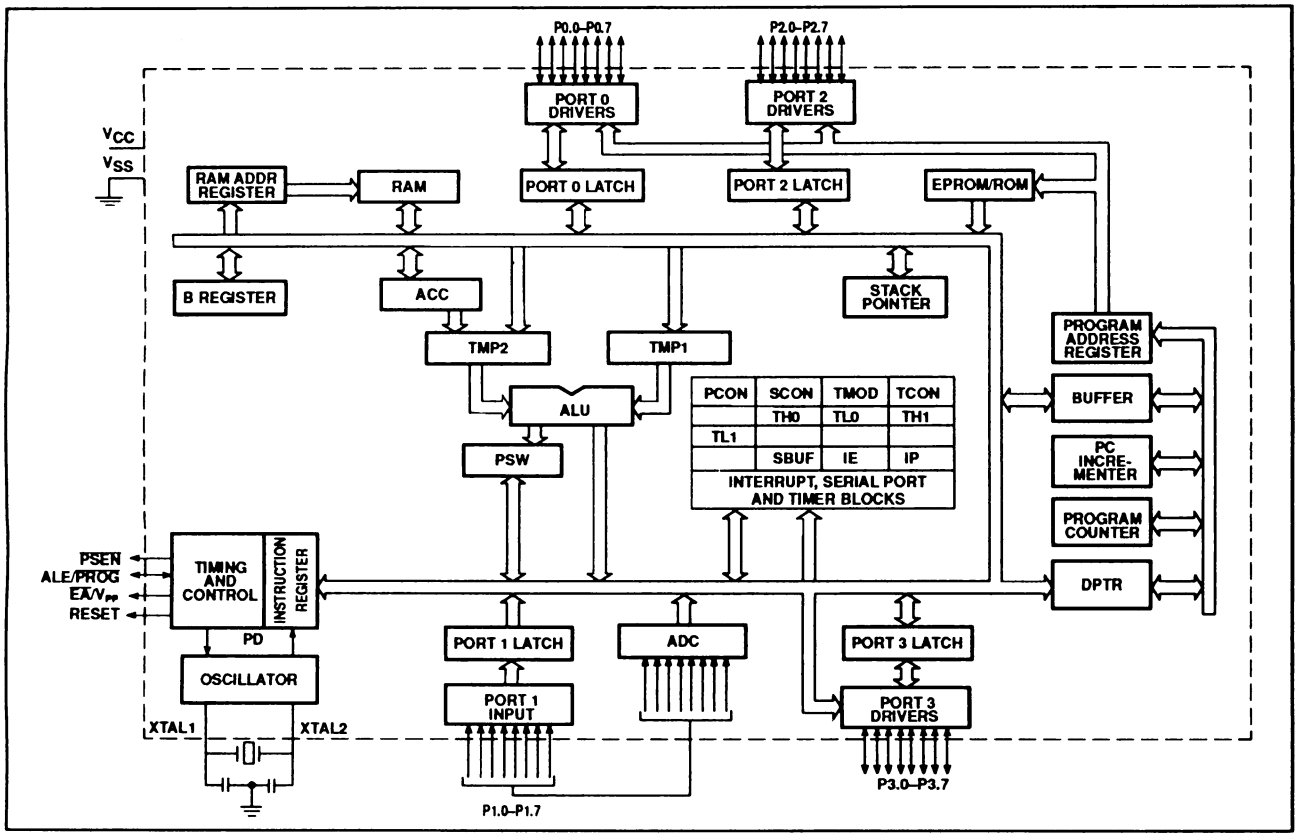
80C550/83C550/87C550 – CMOS Single-Chip 8-Bit Microcontroller with A/D and Watchdog Timer

FEATURES

- 80C51 based architecture
  - 4K × 8 EPROM (87C550)/ ROM (83C550)
  - 128 × 8 RAM
  - Eight channels of 8-bit A/D
  - Two 16-bit counter/timers
  - Watchdog timer
  - Full duplex serial channel
  - Boolean processor
- Memory addressing capability
  - 64K ROM and 64K RAM
- Power control modes:
  - Idle mode
  - Power-down mode
- CMOS and TTL compatible
- Speed range at V_{CC} = 5V ±10%
  - 3.5 to 16MHz
- Four package styles
- Extended temperature ranges
- OTP package available

BLOCK DIAGRAM



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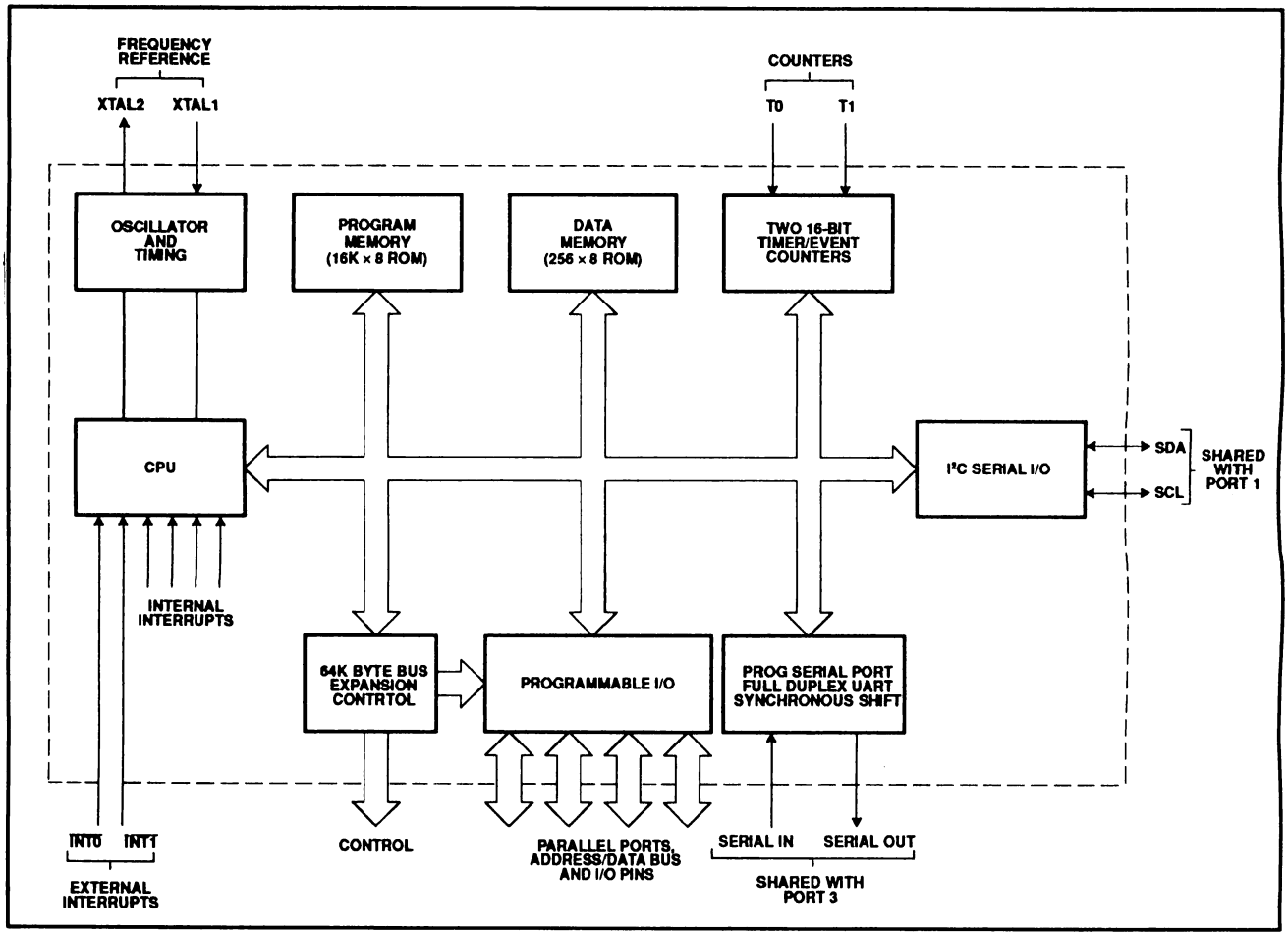
83C654/87C654 – CMOS Single-Chip, 8-Bit Microcontroller

FEATURES

- 80C51 central processing unit
- 16K × 8 ROM expandable externally to 64K bytes
- 256 × 8 RAM, expandable externally to 64K bytes
- Two standard 16-bit timer/counters
- Four 8-bit I/O ports
- I²C-bus serial I/O port with byte oriented master and slave functions
- Full-duplex UART facilities
- Power control modes
  - Idle mode
  - Power-down mode
- Five package styles
- Extended temperature ranges
- OTP package available

BLOCK DIAGRAM



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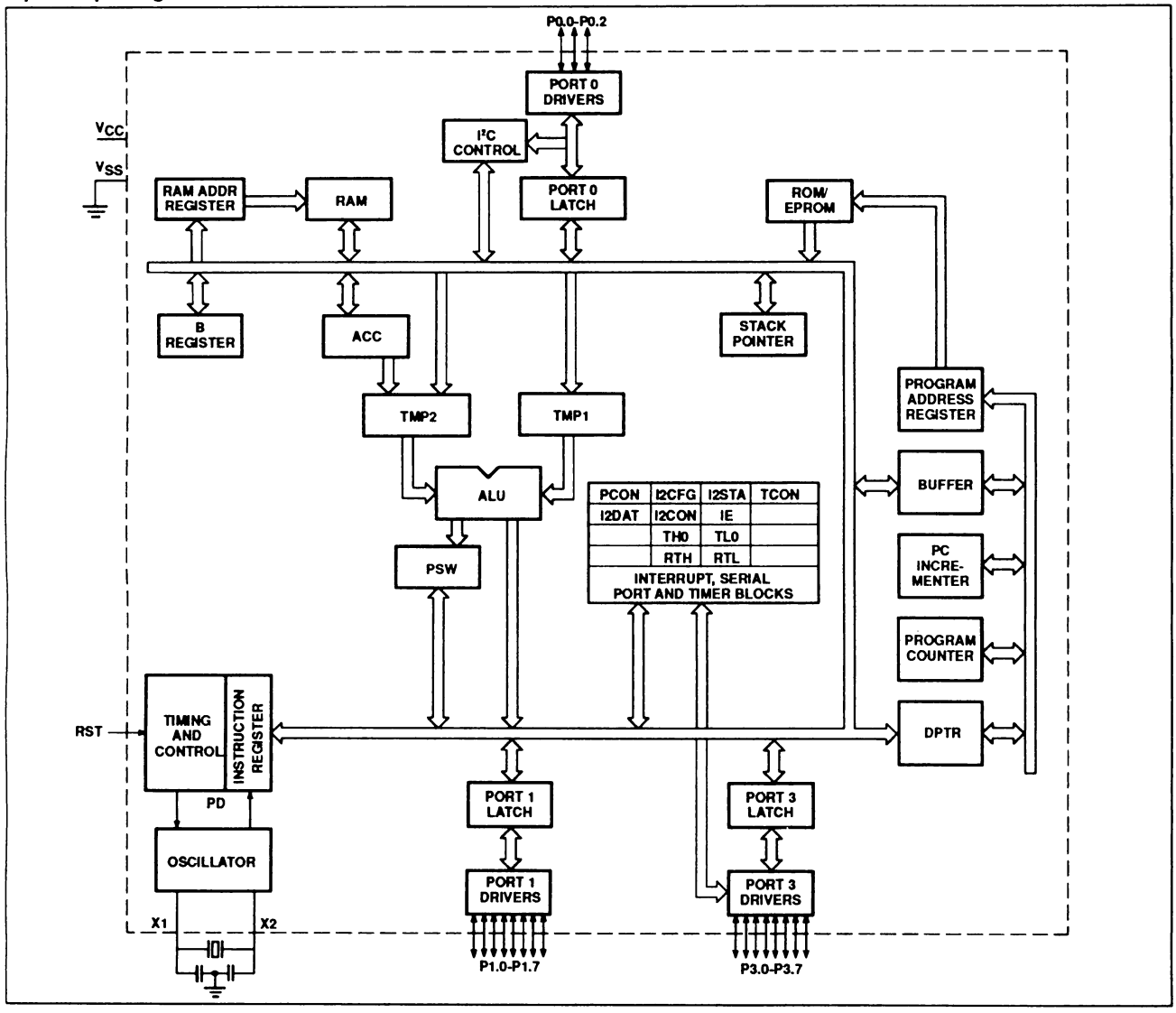
83C751/87C751 – CMOS Single-Chip 8-Bit Microcontroller

FEATURES

- 80C51 based architecture
- Inter-Integrated Circuit (I^2C) serial bus interface
- Small package sizes
  - 24-pin DIP (300 mil "skinny DIP")
  - 28-pin PLCC
- 87C751 available in erasable quartz lid or one-time programmable plastic packages
- Wide oscillator frequency range
- Low power consumption:
  - Normal operation: less than 11mA @ 5V, 12MHz
  - Idle mode
  - Power-down mode
- 2K × 8 ROM (83C751)
  2K × 8 EPROM (87C751)
- 64 × 8 RAM
- 16-bit auto reloadable counter/timer
- Fixed-rate timer
- Boolean processor
- CMOS and TTL compatible
- Well suited for logic replacement, consumer and industrial applications



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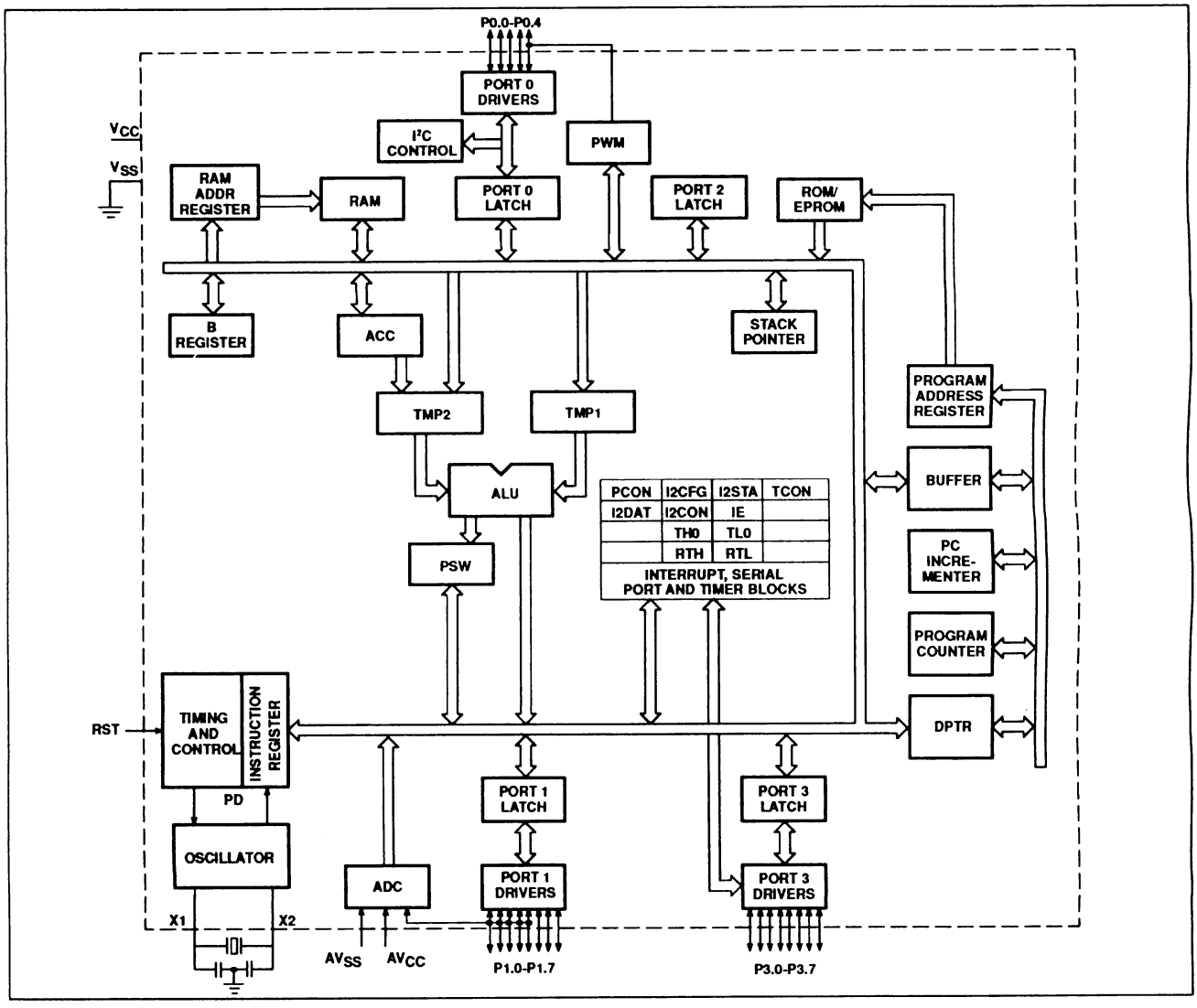
83C752/87C752 – CMOS Single-Chip 8-Bit Microcontroller with A/D, PWM

FEATURES

- Available in erasable quartz lid or One-Time Programmable plastic packages
- 80C51 based architecture
- Inter-integrated Circuit (I^2C) serial bus interface
- Small package sizes
  - 28-pin DIP
  - 28-pin PLCC
- Wide oscillator frequency range
- Low power consumption:
  - Normal operation: less than 11mA @ 5V, 12MHz
  - Idle mode
  - Power-down mode
- 2K × 8 ROM (83C752) EPROM (87C752)
- 64 × 8 RAM
- 16-bit auto reloadable counter/timer
- 5-channel 8-bit A/D converter
- 8-bit PWM output/timer
- Fixed-rate timer
- Boolean processor
- CMOS and TTL compatible
- Well suited for logic replacement, consumer and industrial applications



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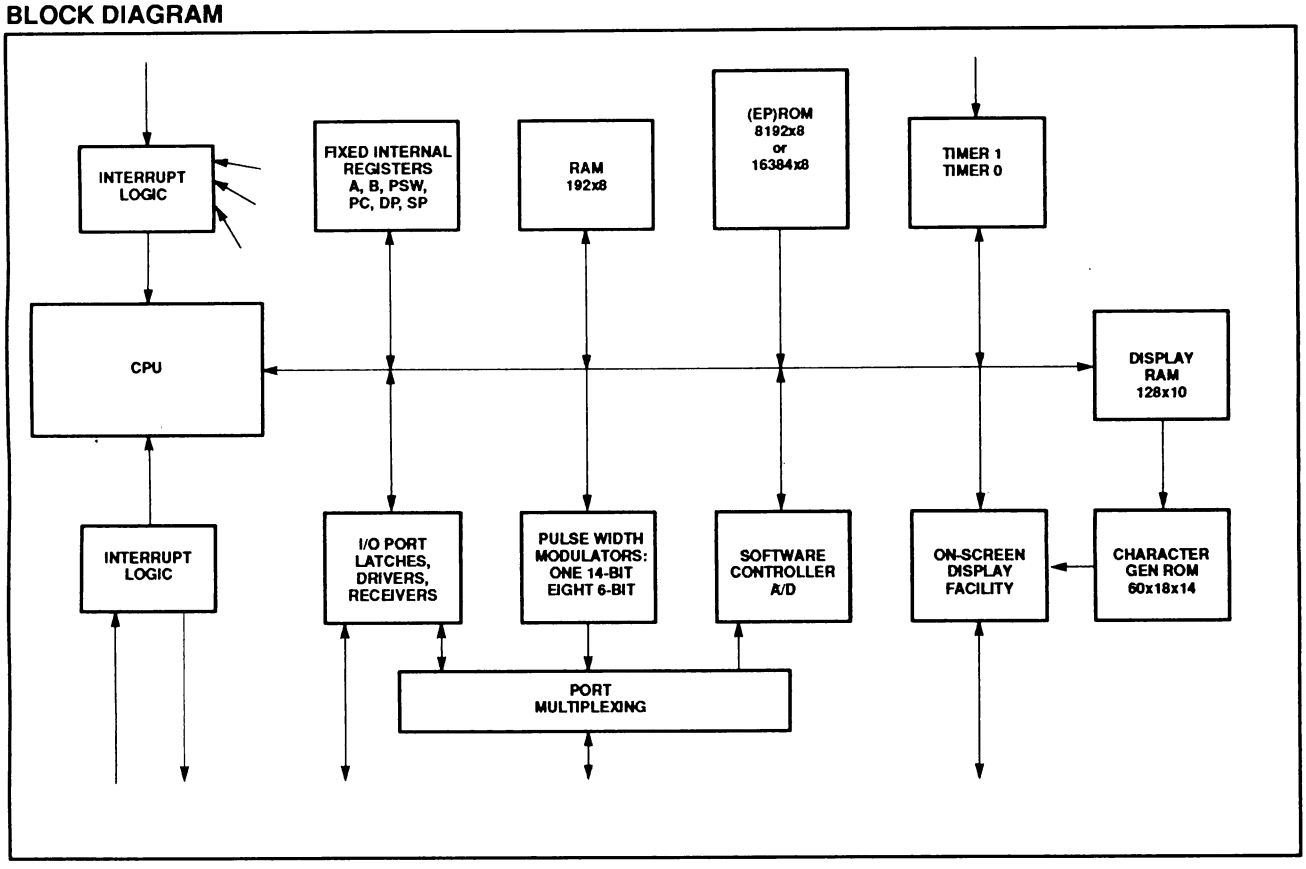
83C053/83C054/87C054 – Microcontroller for Television and Video (MTV)

FEATURES

- 8192 × 8 masked ROM (83C053)
  16384 × 8 masked ROM (83C054)
  16384 × 8 OTPROM (87C054)
- 192 × 8 RAM
- On Screen Display (OSD) Controller
- Three digital video outputs
- Multiplexer/mixer and background intensity controls
- Flexible formatting with OSD New Line Option
- 128 × 10 display RAM
- 60 × 18 × 14 character generator ROM
- Eight text-shadowing modes
- Text color selectable per character
- Background color selectable per word
- Background color vs. video selectable per character
- Eight 6-bit pulse width modulators for analog voltage integration
- One 14-bit PWM for high-precision voltage integration
- D/A converter and comparator with three-input multiplexer
- Nine dedicated I/Os plus 28 port bits
- 15 port bits have alternate uses
- Four high-current open-drain port outputs
- 12 high-voltage (+12V) open drain outputs
- Programmable video input and output polarities
- 80C51 instruction set
- No external memory capability
- 42-pin shrunk DIP (0.07-inch center pins)
- High-speed CMOS technology
- 5V ± 10% operation

BLOCK DIAGRAM



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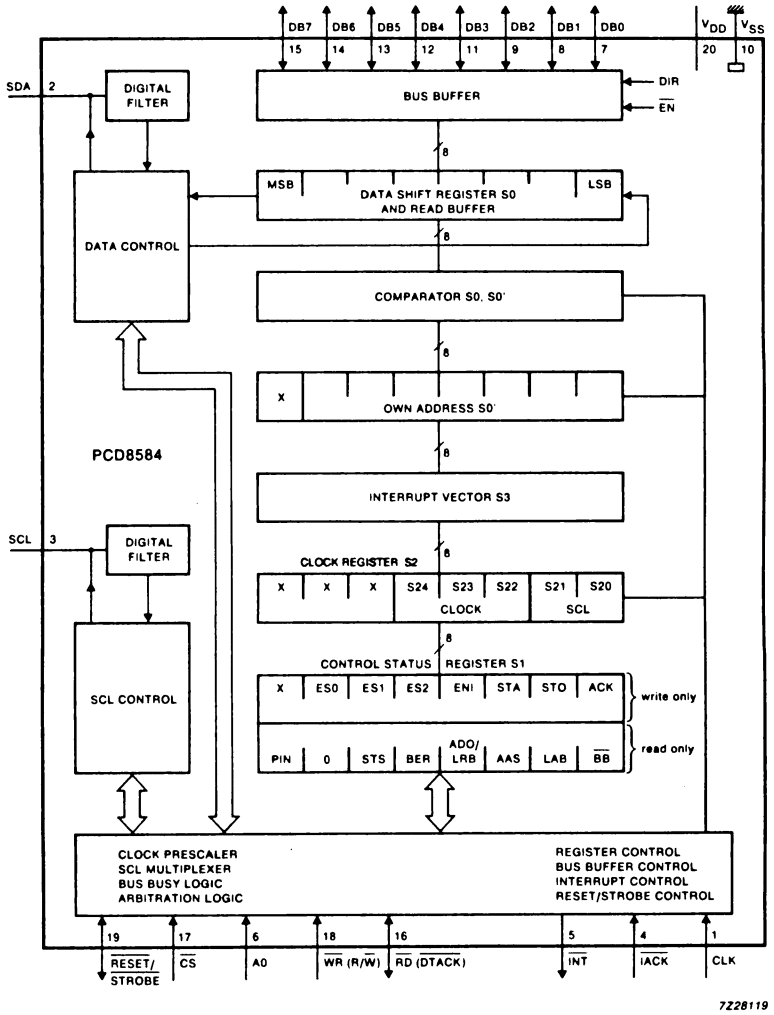
PCD8584 – I²C-Bus Controller

FEATURES

- Parallel-bus/I²C-bus protocol converter
- Compatible with most parallel-bus processors including MAB8049, MAB8051, SCN68000 and Z80
- Automatic selection of bus interface
- Programmable interrupt vector
- Multi-master capability
- I²C-bus monitor mode
- Long-distance mode
- Operating supply voltage 4.5 to 5.5V
- Operating temperature range -20 to 70°C

PCD8584 – BLOCK DIAGRAM



Where:

( ) indicate the SCN68000 pin name designations.
X = don't care.

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PCF8578 – LCD Row/Column Driver for Dot Matrix Graphic Displays

FEATURES

- Single chip LCD controller/driver
- Stand-alone or may be used with up to 32 PCF8579s (40,960 dots possible
- 40 driver outputs, configurable as 32/8, 24/16, 16/24 or 8/32 rows/columns
- Selectable multiplex rates; 1:8, 1:16, 1:24 or 1:32
- Externally selectable bias configuration, 5 or 6 levels
- 1280-bit RAM for display data storage and scratch pad
- Display memory bank switching
- Auto-incremented data loading across hardware subaddress boundaries (with PCF8579)
- Provides display synchronization for PCF8579
- On-chip oscillator, requires only 1 external resistor
- Power-on reset blanks display
- Logic voltage supply range 2.5V to 6.0V
- Maximum LCD supply voltage 9V
- Low power consumption
- I^2C-bus interface
- TTL/CMOS compatible
- Compatible with most microcontrollers
- Optimized pinning for single plane wiring in multiple device applications (with PCF8579)
- Space saving 56-lead plastic mini-pack
- Compatible with chip-on-glass technology

PCF8579 – LCD Row/Column Driver for Dot Matrix Graphic Displays

FEATURES

- LCD column driver
- Used in conjunction with the PCF8578, this device forms part of a chip set capable of driving up to 40,960 dots
- 40 column outputs
- Selectable multiplex rates; 1:8, 1:16, 1:24 or 1:32
- Externally selectable bias configuration, 5 or 6 levels
- Easily cascadable for large applications (up to 32 devices)
- 1280-bit RAM for display data storage
- Display memory bank switching
- Auto-incremented data loading across hardware subaddress boundaries
- Power-on reset blanks display
- Logic voltage supply range 2.5V to 6.0V
- Maximum LCD supply voltage 9V
- Low power consumption
- I^2C-bus interface
- TTL/CMOS compatible
- Compatible with most microcontrollers
- Optimized pinning for single plane wiring in multiple device applications
- Space saving 56-lead plastic mini-pack
- Compatible with chip-on-glass technology

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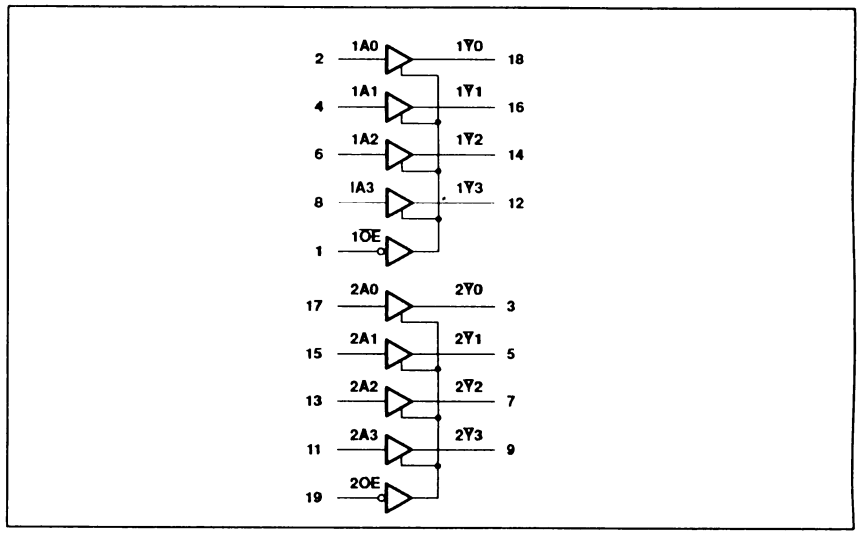
74ABT241 – Octal Buffer/Line Driver (3-State)

FEATURES

- Octal bus interface
- 3-State buffers
- Output capability: +64mA/-32mA
- Latch-up protection exceeds 500mA per JEDEC JC40.2 Std 17
- ESD protection exceeds 2000V per MIL STD 883C Method 3015.6 and 200V per Machine Model
- 4.6ns worst case propagation delay
- 50μA worst case I_{CCZ}

LOGIC DIAGRAM

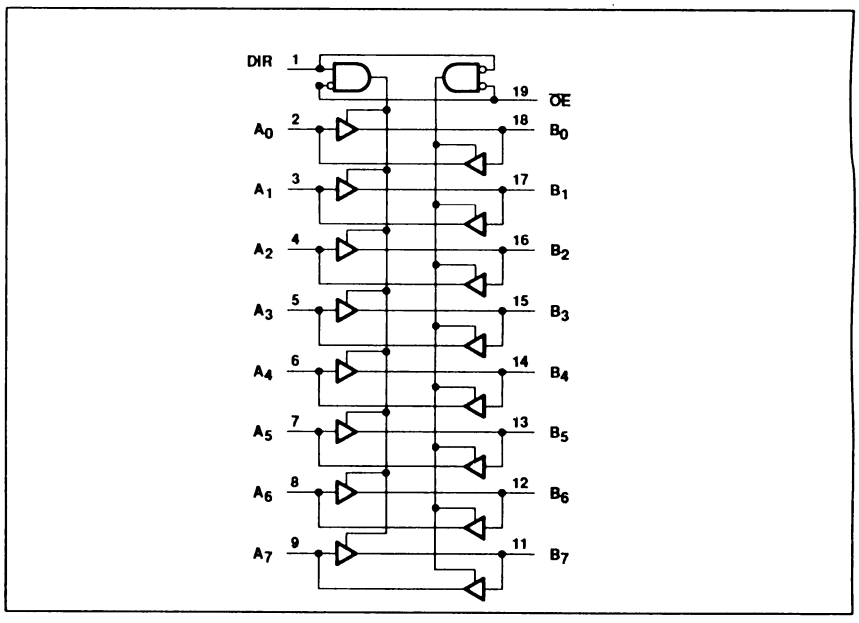


74ABT245 – Octal Transceiver with Directional Pin (3-State)

FEATURES

- Octal bus interface
- 3-State buffers
- Output capability: +64mA/-32mA
- Latch-up protection exceeds 500mA per JEDEC JC40.2 Std 17
- ESD protection exceeds 2000V per MIL STD 883C Method 3015.6 and 200V per Machine Model
- 4.6ns worst case propagation delay
- 50μA worst case I_{CCZ}

LOGIC DIAGRAM



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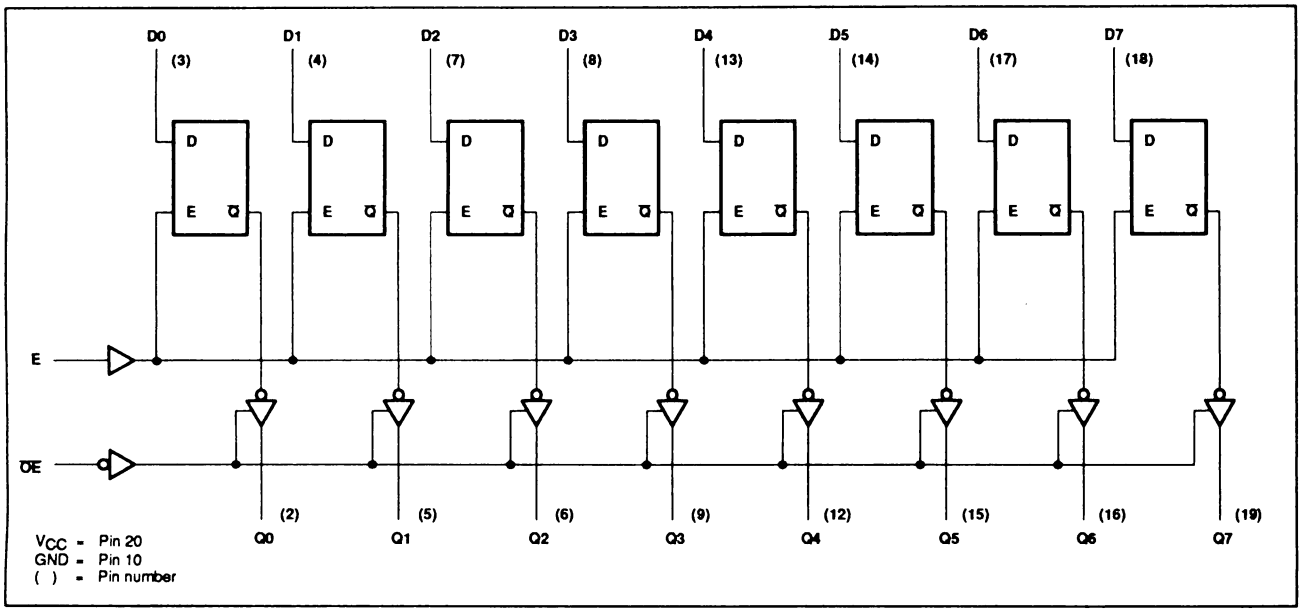
74ABT373 – Octal D-Type Transparent Latch (3-State)

FEATURES

- 8-bit transparent latch
- 3-State output buffers
- Output capability: +64mA/-32mA
- Latch-up protection exceeds 500mA per JEDEC JC40.2 Std 17
- ESD protection exceeds 2000V per MIL STD 883C Method 3015.6 and 200V per Machine Model
- 6.2ns worst case propagation delay
- 50μA worst case I_{CCZ}

LOGIC DIAGRAM



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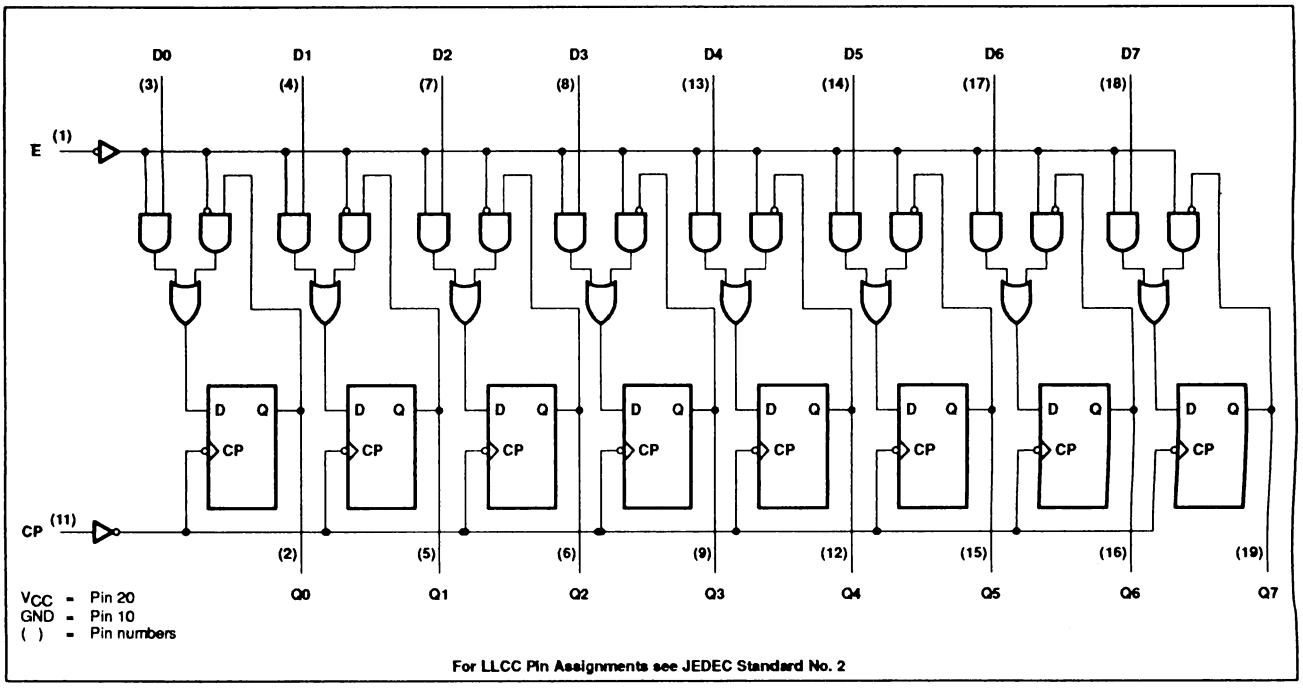
74ABT377 – Octal D-Type Flip-Flop with Enable

FEATURES

- Ideal for addressable register applications
- 8-bit positive edge triggered register
- Enable for address and data synchronization applications
- Output capability: +64mA/-32mA
- Latch-up protection exceeds 500mA per JEDEC JC40.2 Std 17
- ESD protection exceeds 2000V per MIL STD 883C Method 3015.6 and 200V per Machine Model
- 150MHz worst case f_{MAX}
- 50μA worst case I_{CCZ}

LOGIC DIAGRAM



For LLCC Pin Assignments see JEDEC Standard No. 2

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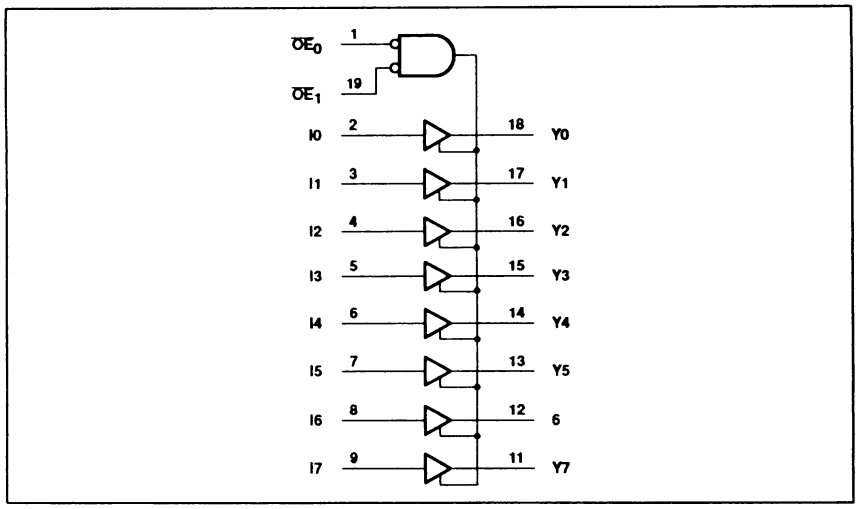
74ABT541 – Octal Buffer/Line Driver (3-State)

FEATURES

- Octal bus interface
- Functions similar to the 74ABT241
- Provides ideal interface and increases fan-out of MOS Microprocessors
- Efficient pinout to facilitate PC board layout
- 3-State buffer outputs sink 64mA and source 32mA
- Latch-up protection exceeds 500mA per JEDEC JC40.2 Std 17
- ESD protection exceeds 2000V per MIL STD 883C Method 3015.6 and 200V per Machine Model
- 125MHz worst case f_{MAX}
- 50μA worst case I_{CCZ}

LOGIC DIAGRAM

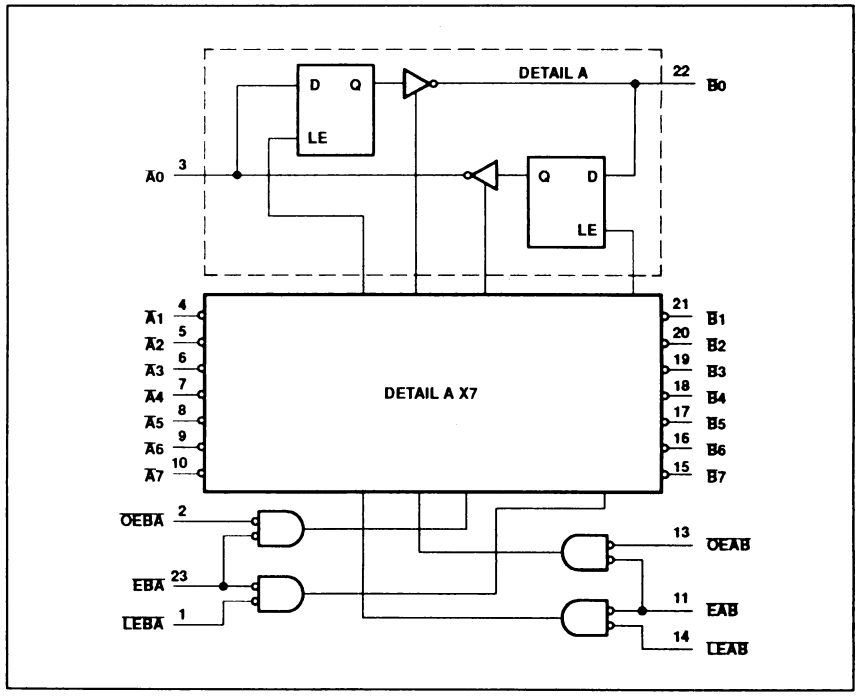


74ABT544 – Octal Latched Transceiver with Dual Enable, Inverting

FEATURES

- Combines 74ABT245 and 74ABT373 type functions in one device
- 8-bit octal transceiver with D-type latch
- Back-to-back registers for storage
- Separate controls for data flow in each direction
- 3-State buffer outputs sink 64mA and source 32mA
- Latch-up protection exceeds 500mA per Jedec JC40.2 Std 17
- ESD protection exceeds 2000V per MIL STD 883C Method 3015.6 and 200V per Machine Model
- Worst case propagation delay is 6.4ns
- Worst case I_{CCZ} is 50μA

LOGIC DIAGRAM



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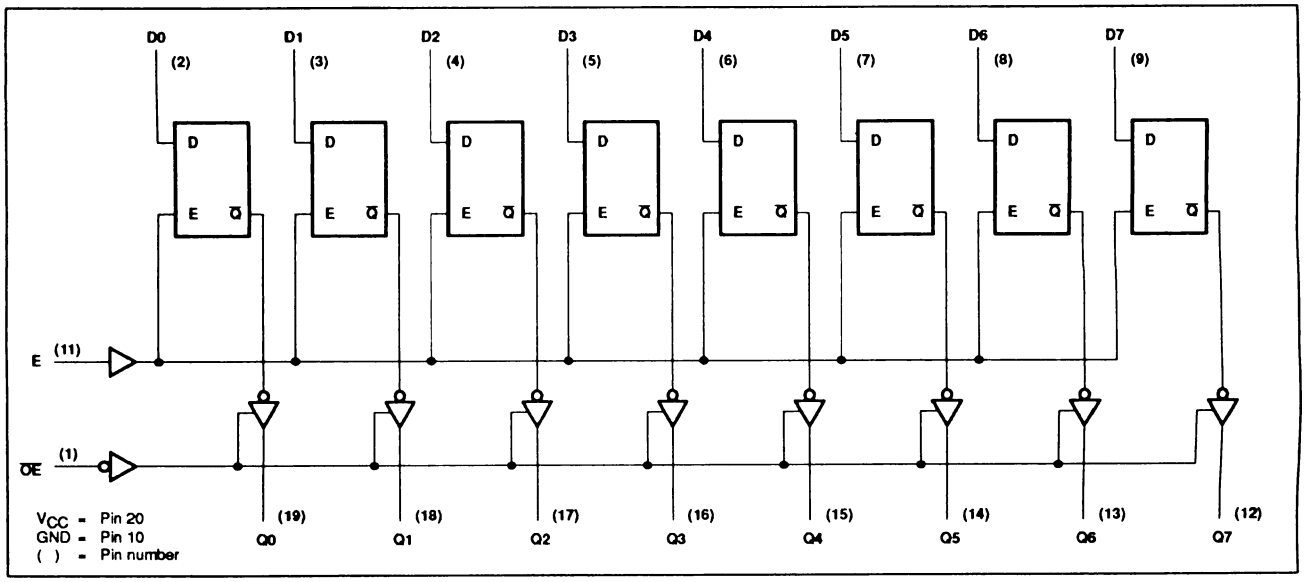
74ABT573 – Octal D-Type Transparent Latch (3-State)

FEATURES

- 74ABT373 is a broadside pinout version of 74ABT373
- Inputs and outputs on opposite side of package allow easy interface to microprocessors
- 3-State outputs for bus interfacing common output enable
- Latch-up protection exceeds 500mA per JEDEC JC40.2 Std 17
- ESD protection exceeds 2000V per MIL STD 883C Method 3015.6 and 200V per Machine Model
- 6.2ns worst case propagation delay
- 50μA worst case I_{CCZ}

LOGIC DIAGRAM



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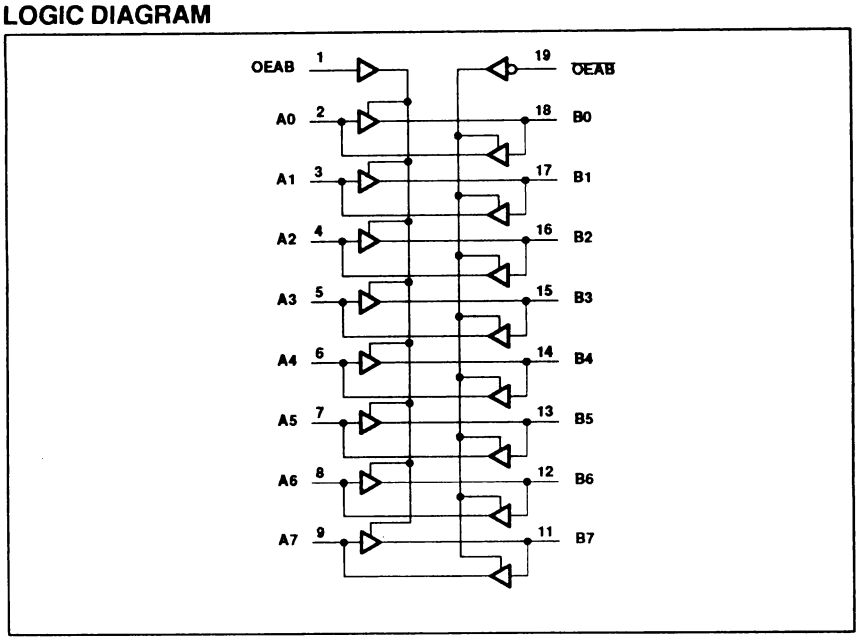
74ABT623 – Octal Transceiver with Dual Enable, Non-Inverting (3-State)

FEATURES

- Octal bidirectional bus interface
- 3-State buffers
- Output capability: +64mA/-32mA
- Latch-up protection exceeds 500mA per JEDEC JC40.2 Std 17
- ESD protection exceeds 2000V per MIL STD 883C Method 3015.6 and 200V per Machine Model
- 4.6ns worst case propagation
- 50μA worst case I_{CCZ}

LOGIC DIAGRAM

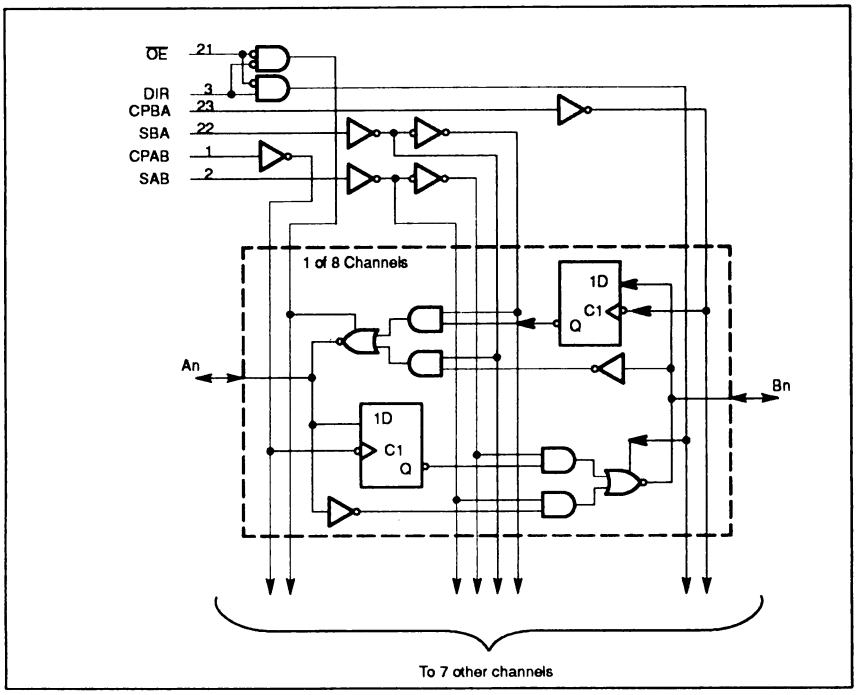


74ABT646 – Octal Bus Transceiver/Register (3-State)

FEATURES

- Combines 74ABT245 and 74ABT374 type functions in one device
- Independent registers for A and B buses
- Multiplexed real-time and stored data
- Output sink 64mA and source 32mA
- Latch-up protection exceeds 500mA per JEDEC JC40.2 Std 17
- ESD protection exceeds 2000V per MIL STD 883C Method 3015.6 and 200V per Machine Model
- 6.9ns worst case propagation
- 50μA worst case I_{CCZ}

LOGIC DIAGRAM



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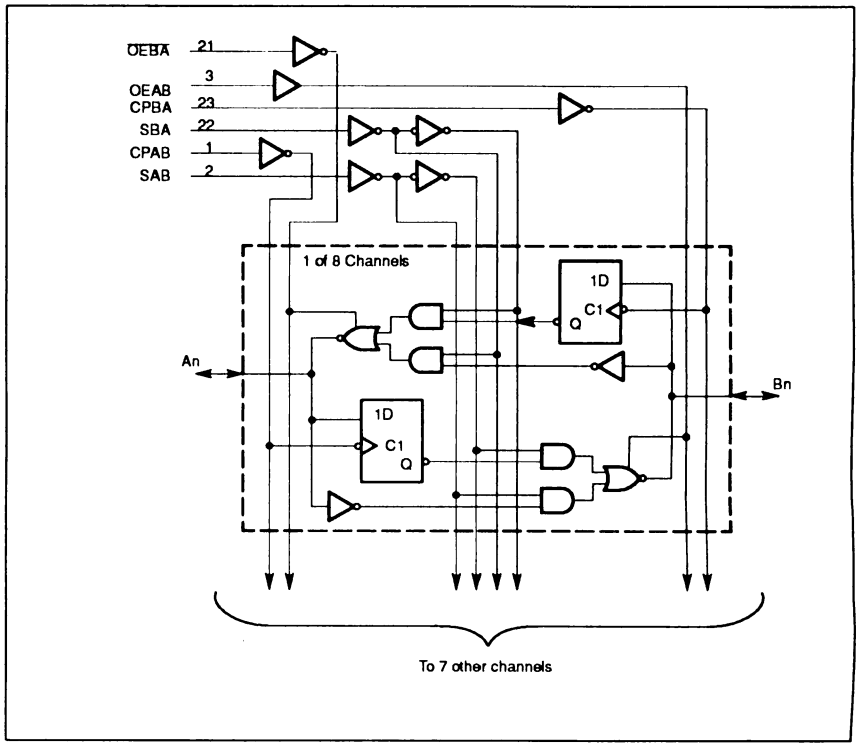
74ABT652 – Transceiver/Register, Non-Inverting (3-State)

FEATURES

- Independent registers for A and B buses
- Multiplexed real-time and stored data
- 3-State outputs
- Output capability: +64mA/-32mA
- Latch-up protection exceeds 500mA per JEDEC JC40.2 Std 17
- ESD protection exceeds 2000V per MIL STD 883C Method 3015.6 and 200V per Machine Model
- 6.7ns worst case propagation
- 50µA worst case I_{CCZ}

LOGIC DIAGRAM



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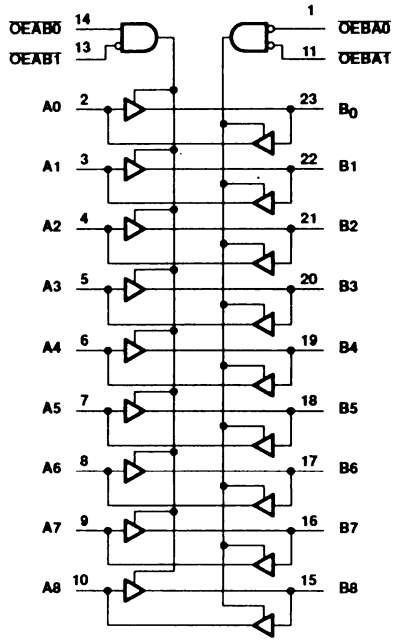
74ABT863 – 9-Bit Bus Transceiver (3-State)

FEATURES

- Provides high performance bus interface buffering for wide data/address paths or buses carrying parity
- Buffered control inputs for light loading or increased fan-in as required with MOS microprocessors
- Broadside pinout compatible with AMD AM29863
- Output capability: +64mA/-32mA
- Latch-up protection exceeds 500mA per JEDEC JC40.2 Std 17
- ESD protection exceeds 2000V per MIL STD 883C Method 3015.6 and 200V per Machine Model
- 6.3ns worst case propagation delay
- 50μA worst case I_{CCZ}

LOGIC DIAGRAM



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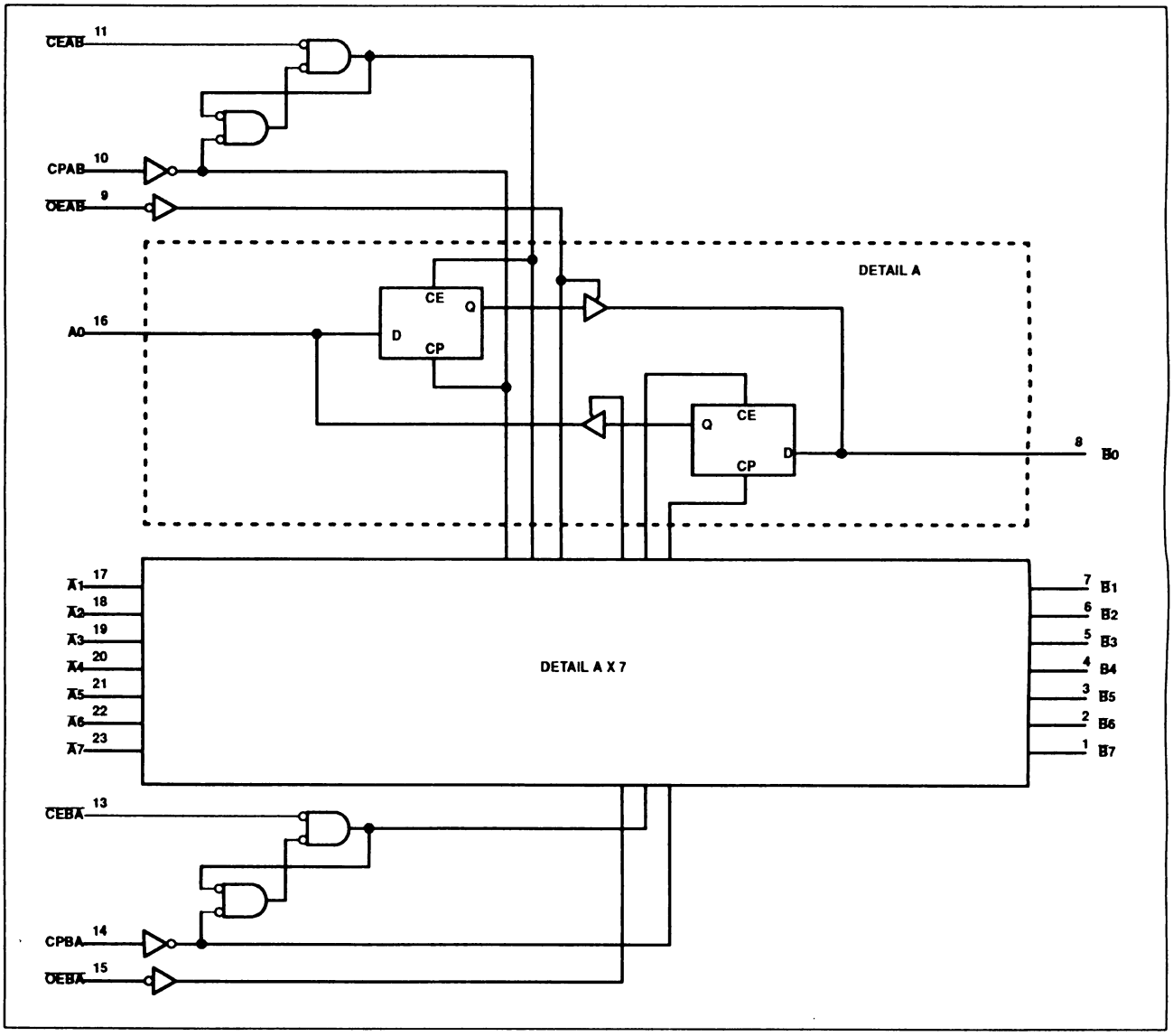
74ABT2953 – Octal Registered Transceiver, Inverting (3-State)

FEATURES

- 8-bit registered inverting transceiver
- Separate clock, clock enable and 3-State enable provided for each register
- AM2953 functional equivalent
- Outputs sink 64mA and source 32mA
- Latch-up protection exceeds 500mA per JEDEC JC40.2 Std 17
- ESD protection exceeds 2000V per MIL STD 883C Method 3015.6 and 200V per Machine Model
- 8.2ns worst case propagation
- 50μA worst case I_{CCZ}

LOGIC DIAGRAM



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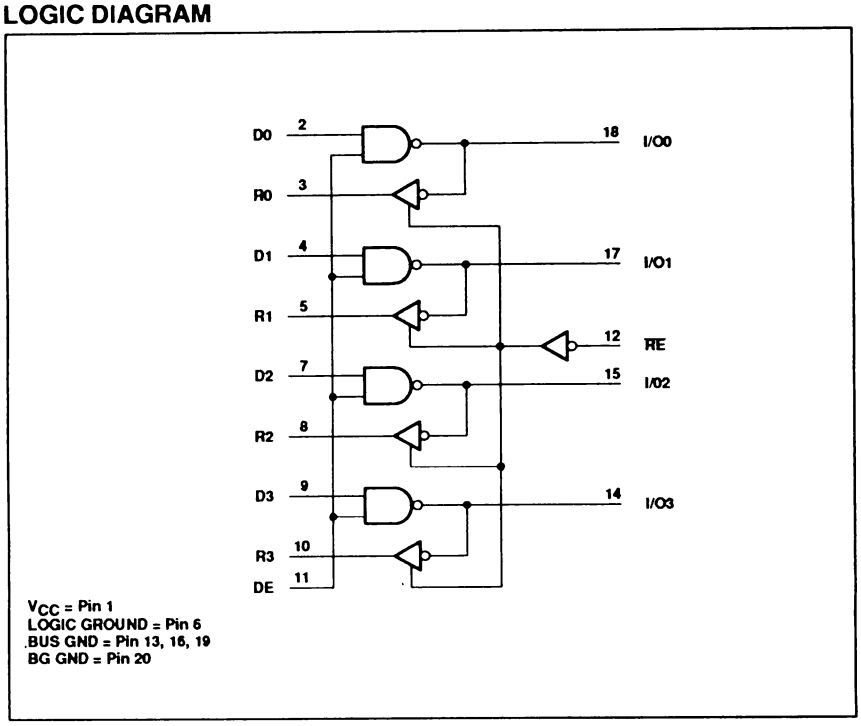
74F3893 – Quad Futurebus Backplane Transceiver (3-State + Open Collector)

FEATURES

- Quad backplane transceiver
- Drives heavily loaded backplanes with equivalent load impedances down to 10Ω
- Futurebus drivers sink 100mA
- Reduced voltage swing (1 volt) produces less noise and reduces power consumption
- High speed operation enhances performance of backplane buses and facilitates incident wave switching
- Compatible with IEEE 896 and IEEE 1194.1 Futurebus Standards
- Built-in precision band-gap (BG) reference provides accurate receiver threshold and improved noise immunity
- Glitch-free power up/power down operation on all outputs
- Pin and function compatible with NSC DS3893

LOGIC DIAGRAM



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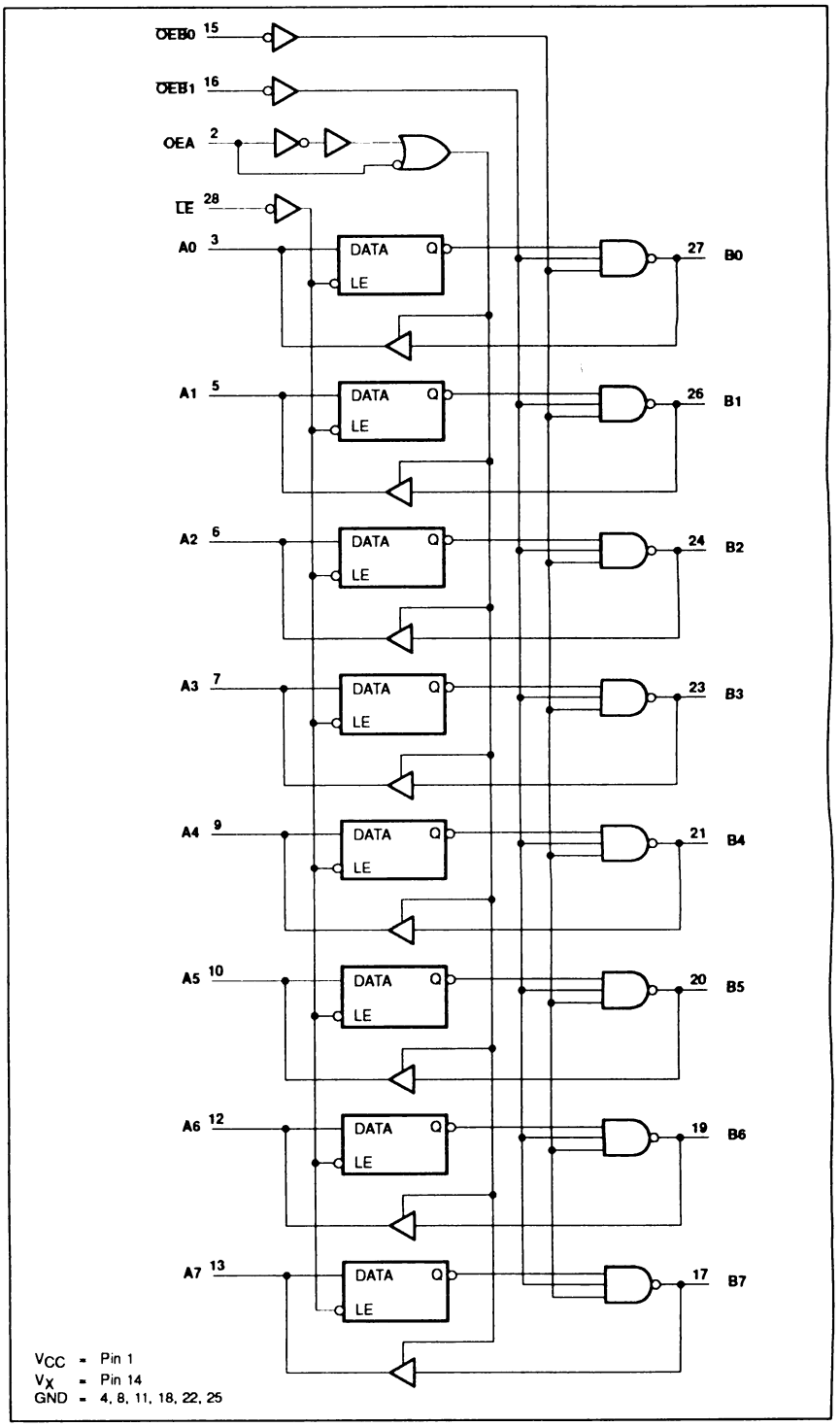
54/74F776 – Pi-Bus Transceiver

FEATURES

- Octal latched transceiver
- Drives heavily loaded backplanes with equivalent load impedances down to 10Ω
- High drive (100mA) open collector drivers on B-port
- Reduced voltage swing (1 volt) produces less noise and reduces power consumption
- High speed operation enhances performance of backplane buses and facilitates incident wave switching
- Compatible with Pi-Bus and IEEE 896 Futurebus Standards
- Built-in precision band-gap reference provides accurate receiver thresholds and improved noise immunity
- Controlled output ramp and multiple GND pins minimize ground bounce
- Glitch-free power up/power down operation
- Multiple package options
- Industrial temperature range available (-40°C to +80°C)

LOGIC DIAGRAM



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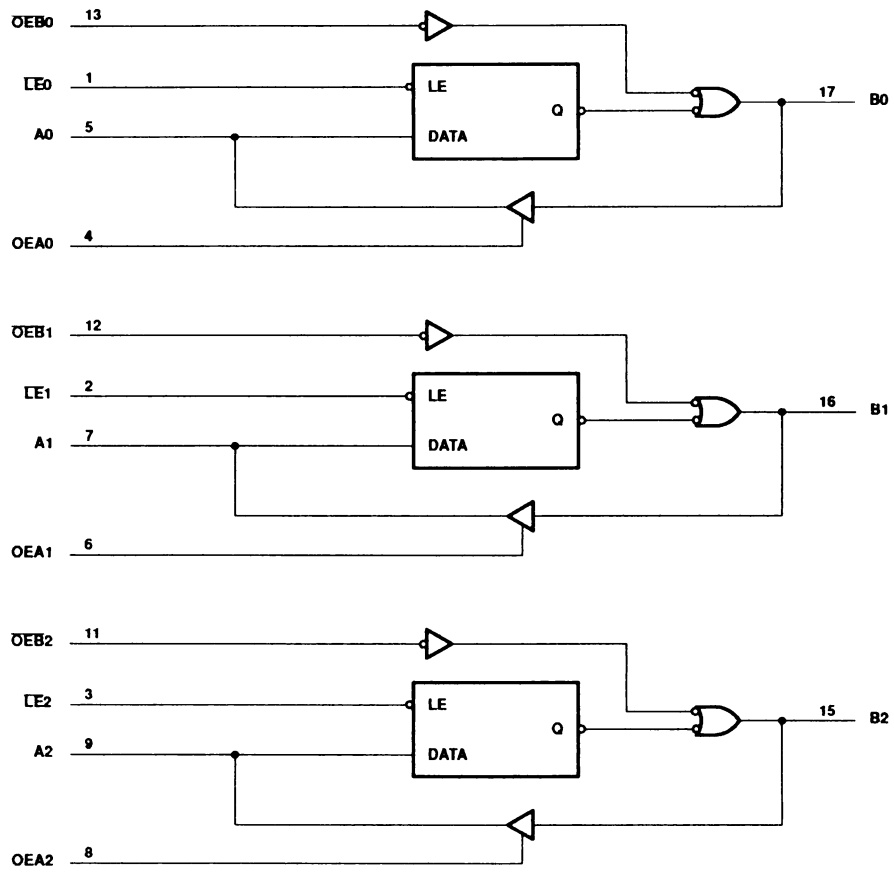
54F777 –Triple Bidirectional Latched Bus Transceiver (3-State + Open Collector)

FEATURES

- Latching transceiver
- High drive open collector output current with minimum output swing
- Compatible with Test Mode (TM) Bus specification
- Controlled output ramp
- Multiple package options

LOGIC DIAGRAM



V_{CC} = Pin 20
V_X = Pin 19
GND = Pin 10, 14, 18

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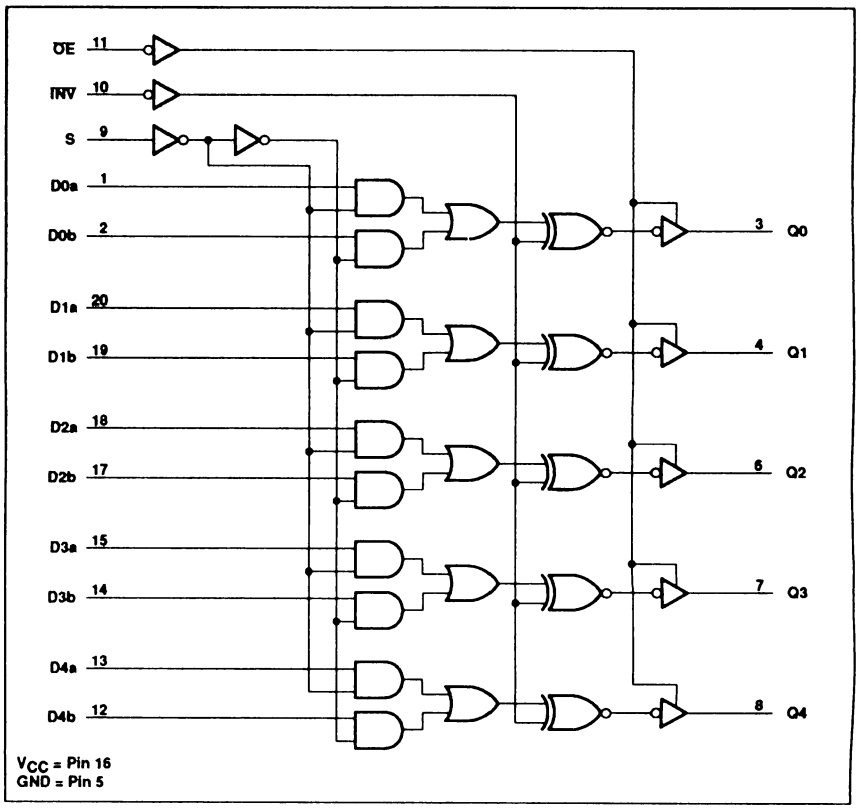
FEATURES for 74F711A/711-1

- Consists of five 2-to-1 multiplexers
- High impedance PNP base inputs for reduced loading (20μA in High and Low states)
- Designed for address multiplexing of dynamic RAM and other applications
- Output inverting/non-inverting option
- 74F711-1 offers 30Ω output impedance characteristics
- Outputs sink 64mA ('F711A only)

FEATURES for 74F712A/712-1

- Consists of five 3-to-1 multiplexers
- High impedance PNP base inputs for reduced loading (20μA in High and Low states)
- Designed for address multiplexing of dynamic RAM and other applications
- 74F712-1 offers 30Ω output impedance characteristics
- Outputs sink 64mA ('F712A only)

LOGIC DIAGRAM



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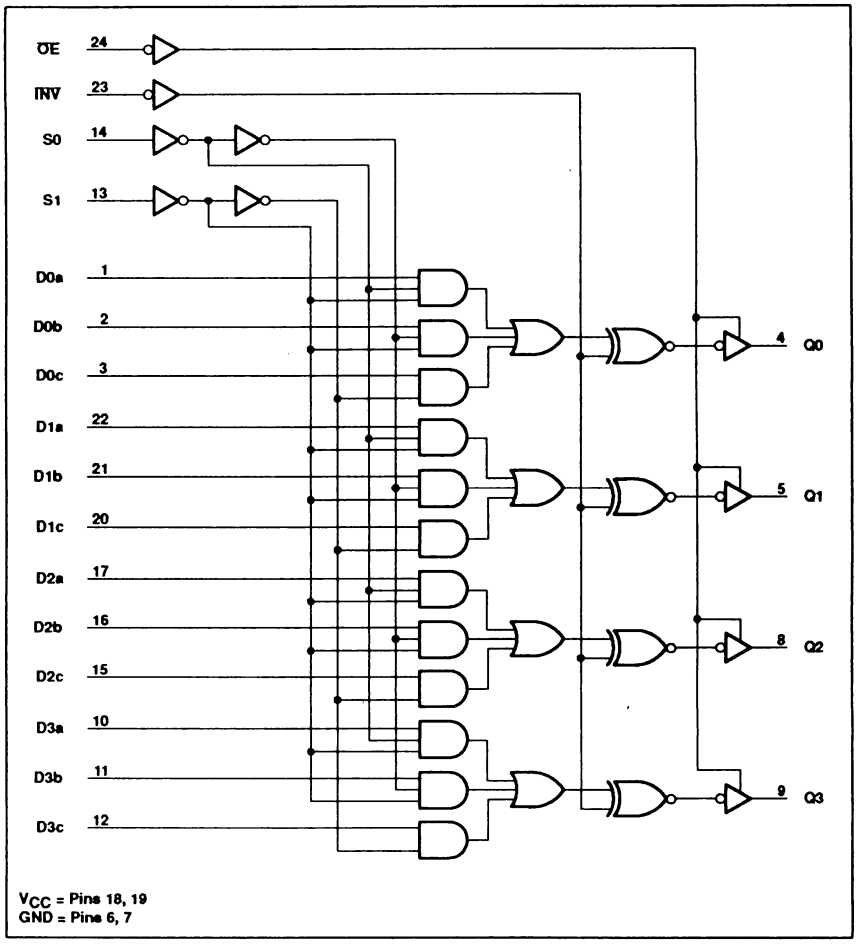
FEATURES for 74F723A/723-1

- Consists of four 3-to-1 multiplexers
- High impedance PNP base inputs for reduced loading (20μA in High and Low states
- Inverting or non-inverting data path capability by an invertint ($\overline{INV}$) input
- Designed for address multiplexing of dynamic RAM and other applications
- Multiple side pins for V_{CC} and GND to reduce lead inductance (improves speed and noise immunity)
- 3-State outputs sink 64mA ('F723 only)
- 74F723-1 offers 30Ω output impedance characteristics

FEATURES for 74F725A/725-1

- Consists of four 4-to-1 multiplexers
- High impedance PNP base inputs for reduced loading (20μA in High and Low states
- Equivalent to two 'F253s without 3-State
- Outputs sink 48mA ('F725A only)
- 74F725-1 offers 30Ω output impedance characteristics

LOGIC DIAGRAM



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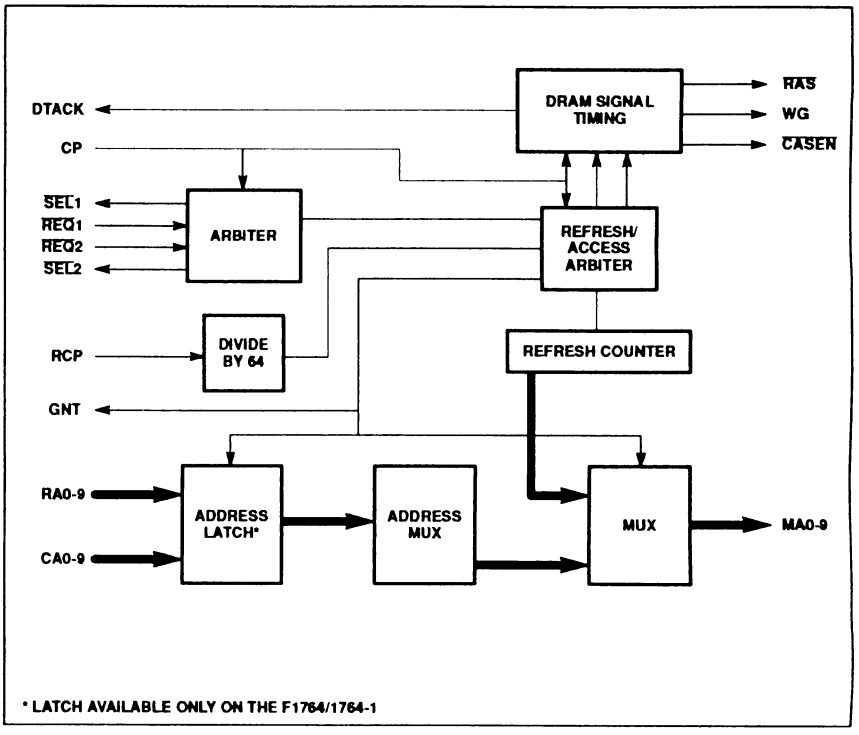
74F1764/1765 74F1764-1/1765-1 – 1Megabit DRAM Dual-Ported Controller

FEATURES

- Allows two microprocessors to access the same bank of dynamic RAM
- Performs arbitration, signal timing, addres multiplexing and refresh
- 10 address output pins allow direct control of up to 1Mbit dynamic RAMs
- External address multiplexing enables control of 4Mbit (or reater) dynamic RAMs
- Separate refresh clock allows adjustable refresh timing
- 74F1764/F1764-1 have on-chip 20-bit address input latch
- Allows control of dynamic RAMs with row access times down to 40ns
- 74F1764/F1765 output drivers designed for incident wave switching
- 74F1764-1/F1765-1 output drivers designed for first reflected wave switching

BLOCK DIAGRAM



74F5074 – Flip-Flop/Clock Driver

FEATURES

- Metastable immune characteristics
- Propagation delay skew and output to output skew guaranteed less than 1.5ns
- High source current (I_{OH} = 15mA) ideal for clock driver applications
- Pinout compatible with 74F74
- See 74F50728 for Synchronizing Cascaded D-Type Flip-Flop
- See 74F50729 for Synchronizing Dual D-Type Flip-Flop with Edge-Triggered Set and Reset
- See 74F50109 for Synchronizing Dual J-K Positive Edge-Triggered Flip-Flops

74F50109 – Flip-Flop/Clock Driver

FEATURES

- Metastable immune characteristics
- Propagation delay skew and output to output skew guaranteed less than 1.5ns
- High source current (I_{OH} = 15mA) ideal for clock driver applications
- Pinout compatible with 74F109
- See 74F5074 for Synchronizing Dual D-Type Flip-Flop
- See 74F50728 for Synchronizing Cascaded D-Type Flip-Flop
- See 74F50729 for Synchronizing Dual D-Type Flip-Flop with Edge-Triggered Set and Reset

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74F50729 – Flip-Flop/Clock Driver

FEATURES

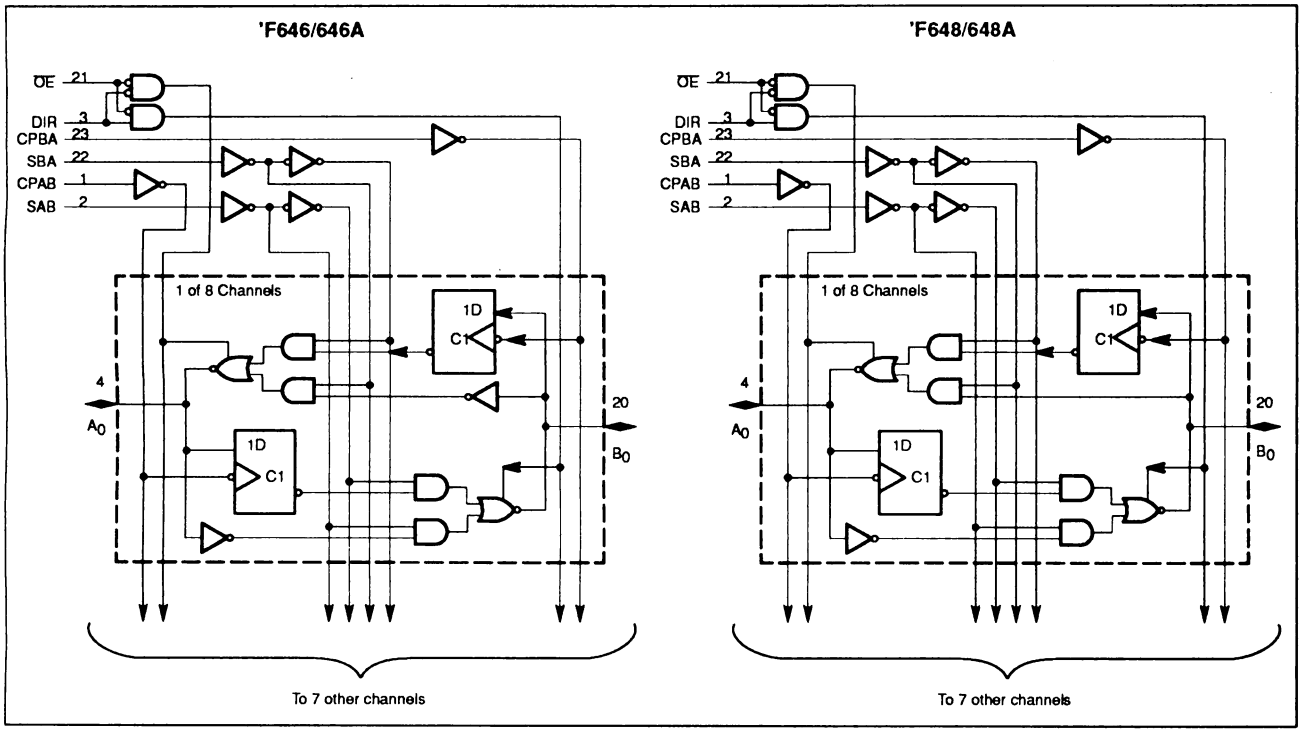
- Metastable immune characteristics
- Propagation delay skew and output to output skew less than 1.5ns
- High source current (I_{OH} = 15mA) ideal for clock driver applications
- See 74F5074 for Synchronizing Dual D-Type Flip-Flop
- See 74F50109 for Synchronizing Dual J-$\overline{K}$ Positive Edge-Triggered Flip-Flops
- See 74F50728 for Synchronizing Cascaded Dual D-Type Flip-Flop

74F646/646A, 74F648/648A – Transceivers/Registers

FEATURES

- Combines 54F245 and 54F374 type functions in one chip
- High impedance base inputs for reduced loading (70μA in High and Low states)
- Independent registers for A and B buses
- Multiplexed real-time and stored data
- Choice of non-inverting and inverting data paths
- Controlled ramp outputs for 'F646A/'F648A
- 3-State outputs
- 300 mil wide 24-pin (Slim Dip) package

LOGIC DIAGRAM



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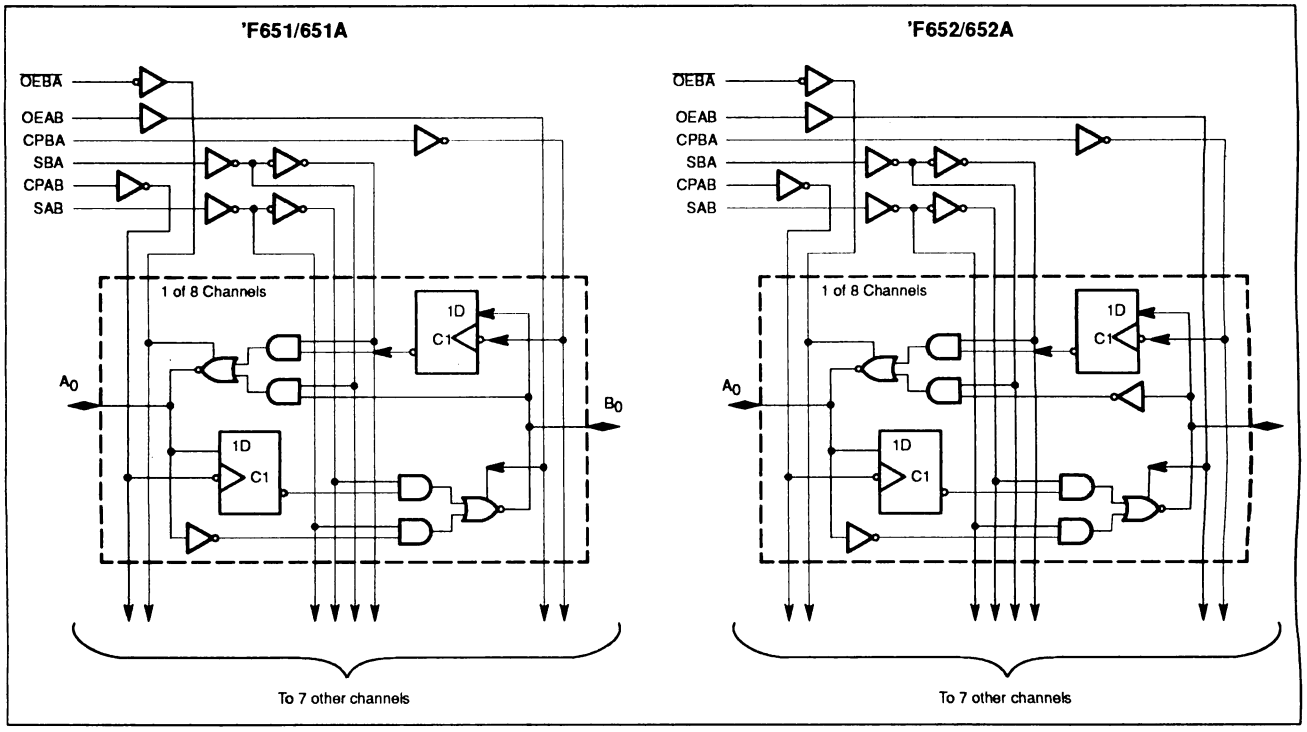
74F651/651A, 74F652/652A – Transceivers/Registers

FEATURES

- Combines 54F245 and 54F374 type functions in one chip
- High impedance base inputs for reduced loading (70μA in High and Low states)
- Independent registers for A and B buses
- Multiplexed real-time and stored data
- Choice of non-inverting and inverting data paths
- 3-State outputs

LOGIC DIAGRAM



74HC/HCT5555 – Programmable Delay Timer with Oscillator

FEATURES

- Positive and negative edge triggered
- Retriggerable or non-retriggerable
- Programmable delay
  minimum: 100ns
  maximum: depends on input frequency and division ratio
- Divide by range of 2 to 2^{24}
- Direct reset terminates output pulse
- Very low power consumption in triggered start mode
- 3 oscillator operation modes:
  RC oscillator
  Crystal oscillator
  External oscillator
- Device is unaffected by variations in temperature and V_{CC}, when using an external oscillator
- Automatic power-on reset
- Schmitt trigger action on both trigger inputs
- Direct drive for power transistor
- Output capability: 20mA
- I_{CC} category: MSI

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MB2241 – 16-Bit Buffer/Line Driver (3-State)

Preliminary Specification

FEATURES

- **16-bit bus interface**
- **Multiple V_{CC} and GND pins minimize switching noise**
- **3-State buffers**
- **Output capability: +64mA/-32mA**
- **Latch-up protection exceeds 500mA per JEDEC JC40.2 Std 17**
- **ESD protection exceeds 2000V per MIL STD 883C Method 3015.6 and 200V per Machine Model**

DESCRIPTION

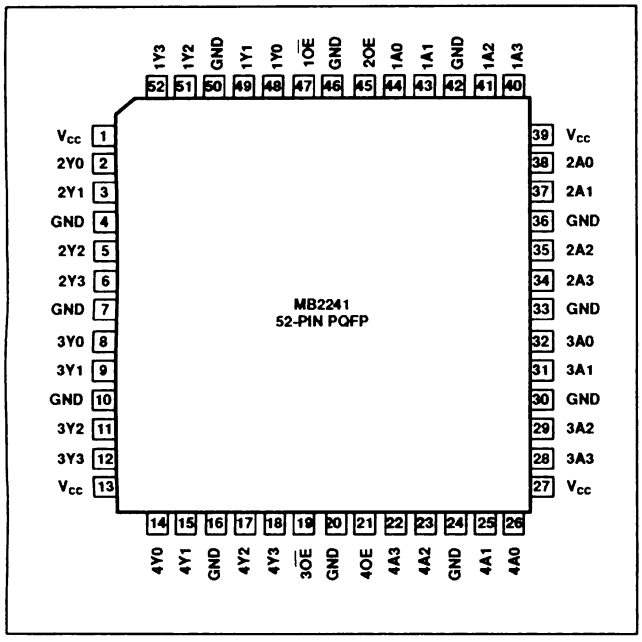
The MB2241 high-performance BiCMOS device combines low static and dynamic power dissipation with high speed and high output drive.

The MB2241 device is a 16-bit buffer that is ideal for driving bus lines. The device features four Output Enables ($1\overline{OE}$, 2OE, $3\overline{OE}$, 4OE), each controlling four of the 3-State outputs.

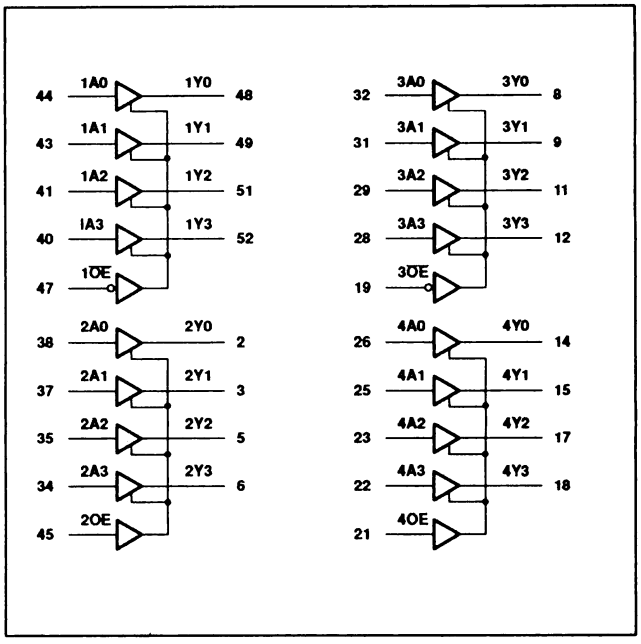
ORDERING INFORMATION

DESCRIPTION	TEMP. RANGE	ORDER CODE
52-Pin Plastic QFP	-40°C to +85°C	MB2241B

PIN CONFIGURATION



LOGIC DIAGRAM



Signetics/Philips Components

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MB2245 – Dual Octal Transceivers with Direction Pins (3-State)

Preliminary Specification

FEATURES

- **16-bit bidirectional bus interface**
- **Multiple V_{CC} and GND pins minimize switching noise**
- **3-State buffers**
- **Output capability: +64mA/-32mA**
- **Latch-up protection exceeds 500mA per JEDEC JC40.2 Std 17**
- **ESD protection exceeds 2000V per MIL STD 883C Method 3015.6 and 200V per Machine Model**

DESCRIPTION

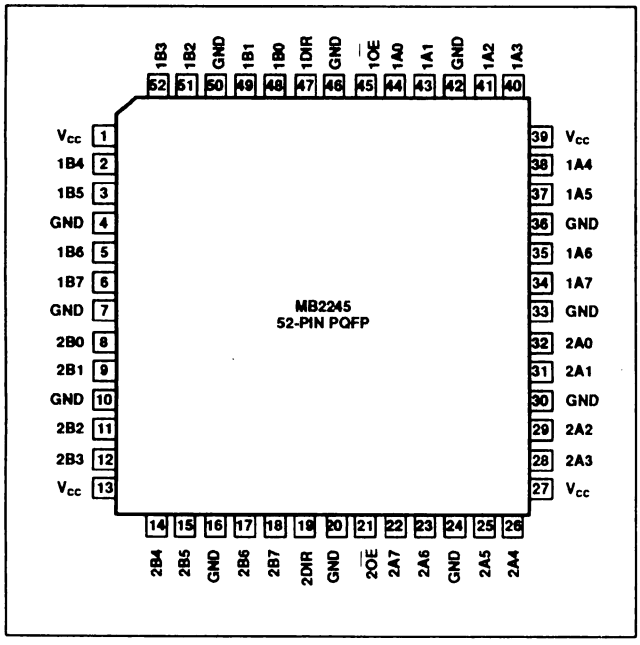
The MB224 high-performance BiCMOS device combines low static and dynamic power dissipation with high speed and high output drive.

The MB2245 device is a dual octal transceiver featuring non-inverting 3-State bus compatible outputs in both send and receive directions. The control function implementation minimizes external timing requirements. The device features two Output Enable ($1\overline{OE}$, $2\overline{OE}$) inputs for easy cascading and two Direction (1DIR, 2DIR) inputs for direction control.

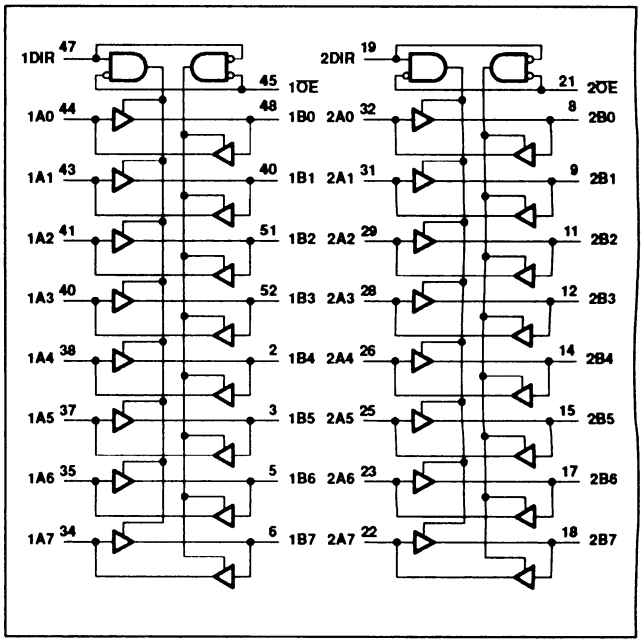
ORDERING INFORMATION

DESCRIPTION	TEMP. RANGE	ORDER CODE
52-Pin Plastic QFP	-40°C to +85°C	MB2245B

PIN CONFIGURATION



LOGIC DIAGRAM



Signetics/Philips Components

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MB2541 – Dual Octal Buffer/Line Drivers (3-State)

Preliminary Specification

FEATURES

- **16-bit bus interface**
- **Multiple V_{CC} and GND pins minimize switching noise**
- **Provides ideal interface and increases fan-out of MOS Microprocessors**
- **Efficient pinout to facilitate PC board layout**
- **3-State buffer outputs sink 64mA and source 32mA**
- **Latch-up protection exceeds 500mA per JEDEC JC40.2 Std 17**
- **ESD protection exceeds 2000V per MIL STD 883C Method 3015.6 and 200V per Machine Model**

DESCRIPTION

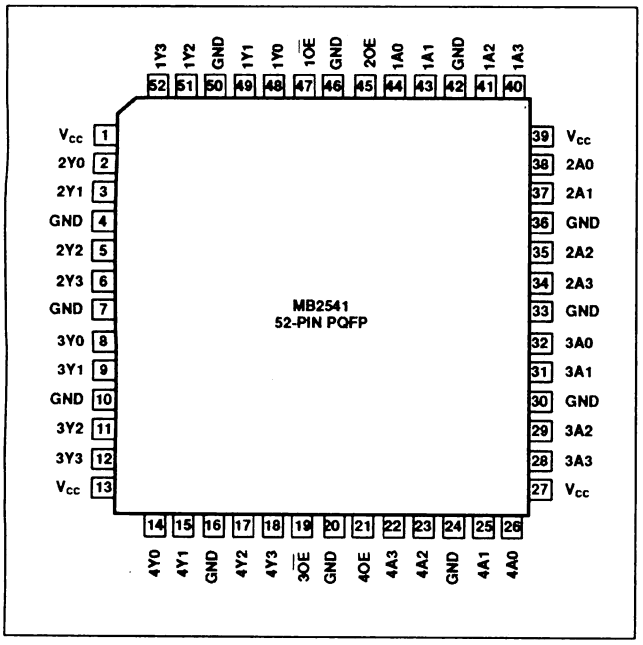
The MB2541 high-performance BiCMOS device combines low static and dynamic power dissipation with high speed and high output drive.

The MB2541 has two octal buffers that are ideal for driving bus lines. The outputs are all capable of sinking 64mA and sourcing 32mA.

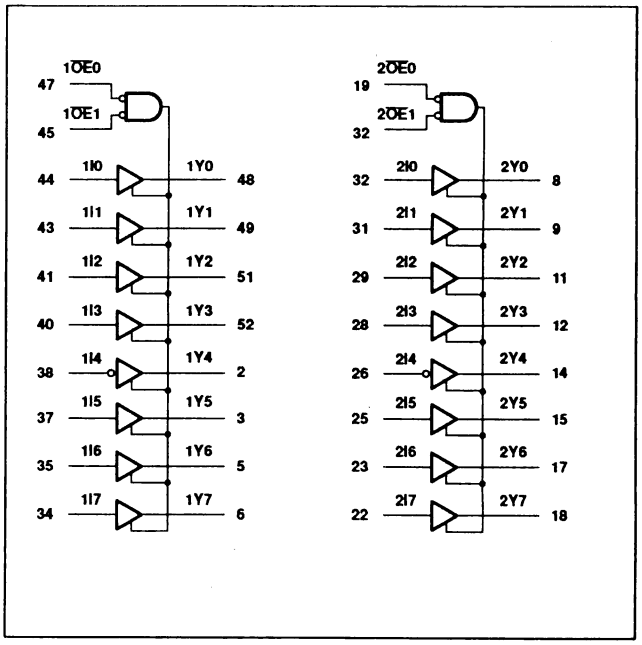
ORDERING INFORMATION

DESCRIPTION	TEMP. RANGE	ORDER CODE
52-Pin Plastic QFP	-40°C to +85°C	MB2541B

PIN CONFIGURATION



LOGIC DIAGRAM



Signetics/Philips Components

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MB2623 – Dual Octal Transceiver with Dual Enable, Non-Inverting (3-State)

Preliminary Specification

FEATURES

- **16-bit bidirectional bus interface**
- **3-State buffers**
- **Multiple V_{CC} and GND pins minimize switching noise**
- **Output capability: +64mA/-32mA**
- **Latch-up protection exceeds 500mA per JEDEC JC40.2 Std 17**
- **ESD protection exceeds 2000V per MIL STD 883C Method 3015.6 and 200V per Machine Model**

DESCRIPTION

The MB2623 high-performance BiCMOS device combines low static and dynamic power dissipation with high speed and high output drive.

The MB2623 device is a dual octal transceiver featuring non-inverting 3-State bus compatible outputs in both send and receive directions. The MB2623 is designed for asynchronous two-way communication between data buses.

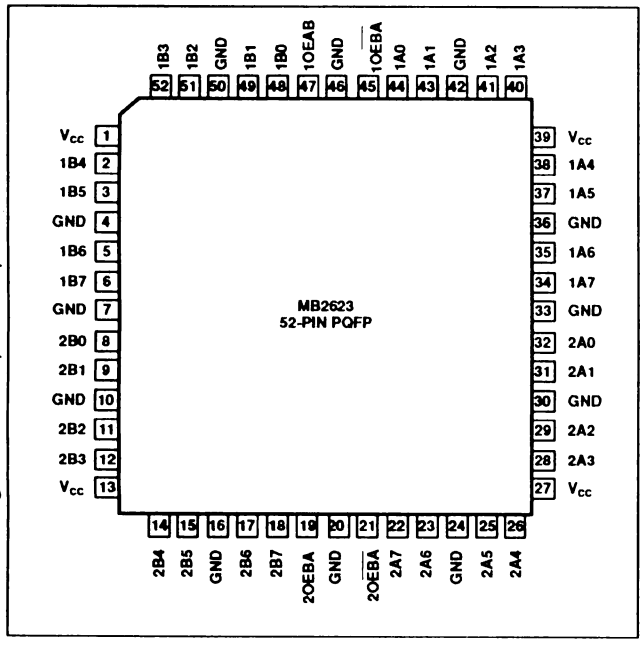
The control function implementation allows for maximum flexibility in timing.

This device allows data transmission from the A bus to the B bus or from the B bus to the A bus, depending upon the logic levels at the Enable Inputs (n$\overline{OEB}$ and nOEAB). The Enable inputs can be used to disable the device so that the buses are effectively isolated.

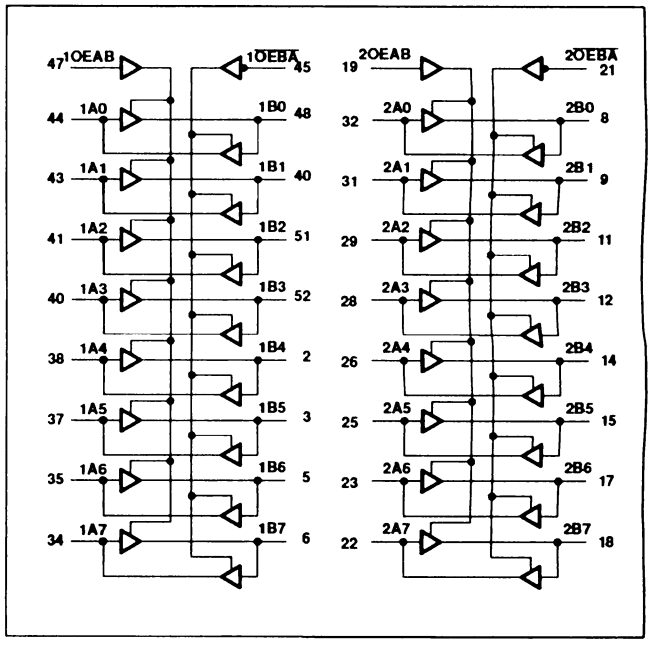
ORDERING INFORMATION

DESCRIPTION	TEMP. RANGE	ORDER CODE
52-Pin Plastic QFP	-40°C to +85°C	MB2623B

PIN CONFIGURATION



LOGIC DIAGRAM



Signetics/Philips Components

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PHD16N8-5 – Programmable High-Speed Decoder Logic (16 × 16 × 8)

DESCRIPTION

The PHD16N8-5 is an ultra fast Programmable High-speed Decoder featuring a 5ns maximum propagation delay. The architecture has been optimized using Philips Components-Signetics state-of-the-art bipolar oxide isolation process coupled with titanium-tungsten fuses to achieve superior speed in any design.

The PHD16N8-5 is a single level logic element comprised of 10 fixed inputs, 8 AND gates, and 8 outputs of which 6 are bidirectional. This gives the device the ability to have as many as 16 inputs. Individual 3-State control of all outputs is also provided.

The device is field-programmable, enabling the user to quickly generate custom patterns using standard programming equipment. Proprietary designs can be protected by programming the security fuse.

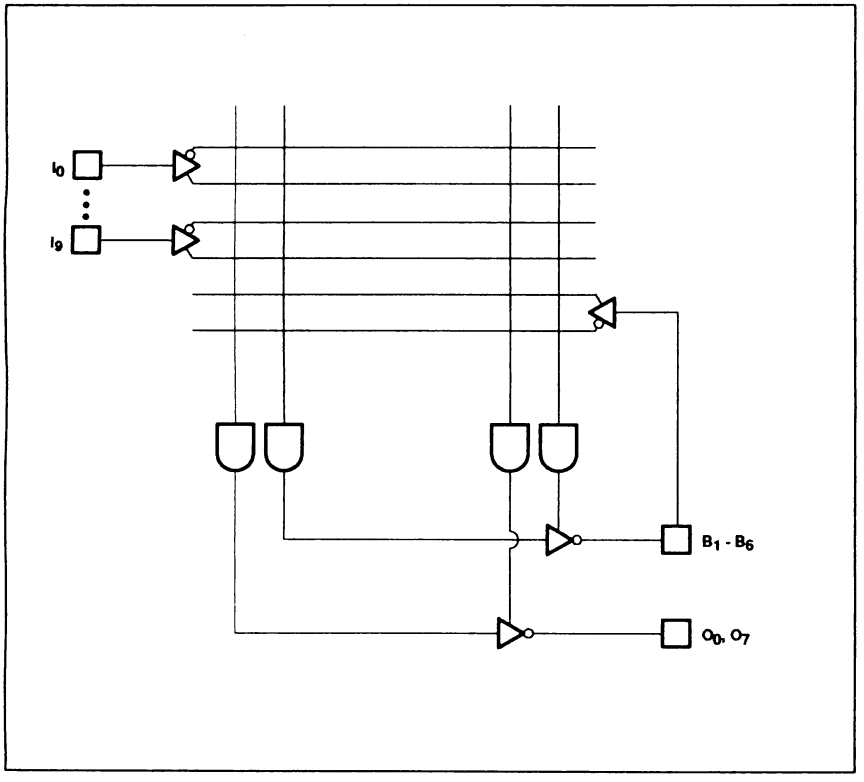
FEATURES

- **Ideal for high speed system decoding**
- **Super high speed at 5ns t_{PD}**
- **10 dedicated inputs**
- **8 outputs**
  - **6 bidirectional I/O**
  - **2 dedicated outputs**
- **Security fuse to prevent duplication of proprietary designs.**
- **Individual 3-State control of all outputs**
- **Field-programmable on industry standard programmers**
- **Available in 20-pin Plastic DIP and 20-Pin PLCC**

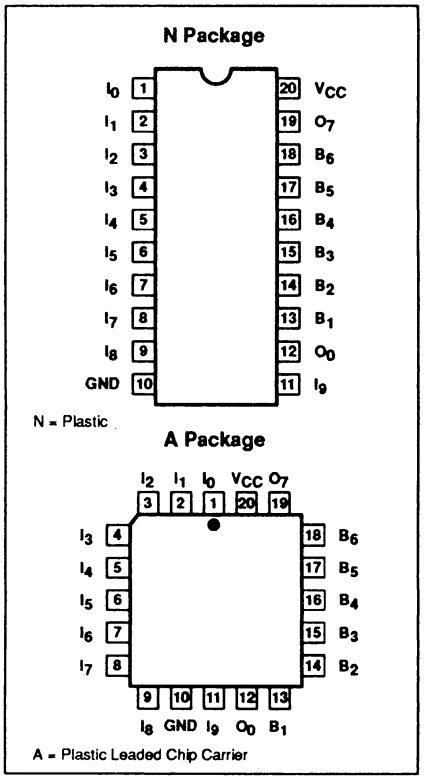
APPLICATIONS

- **High speed memory decoders**
- **High speed code detectors**
- **Random logic**
- **Peripheral selectors**
- **Machine state decoders**
- **Footprint compatible to 16L8**
- **Fuse/Footprint compatible to TIBPAD**

FUNCTIONAL DIAGRAM



PIN CONFIGURATION



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PLC42VA12 – CMOS Programmable Logic Sequencer (42 × 105 × 12)

DESCRIPTION

The new PLC42VA12 CMOS PLD from Signetics exhibits a unique combination of the two architectural concepts that revolutionized the PLD marketplace.

The Signetics unique Output Macro Cell (OMC) embodies all the advantages and none of the disadvantages associated with the "V" type Output Macro Cell devices. This new design, combined with added functionality of two programmable arrays, represents a significant advancement in the configurability and efficiency of multi-function PLDs.

The most significant improvement in the Output Macro Cell structure is the implementation of the register bypass function. Any of the 10 J-K/D registers can be individually bypassed, thus creating a combinatorial I/O path from the AND array to the output pin. Unlike other "V" type devices, the register in the PLC42VA12 Macro Cell remains fully functional as a buried register. Both the combinatorial I/O and buried register have separate input paths (from the AND array). In most V-type architectures, the register is lost as a resource when the cell is configured as a combinatorial I/O. This feature provides the capability to operate the buried register independently from the combinatorial I/O.

The PLC42VA12 is an EPROM-based CMOS device. Designs can be generated using Signetics SNAP 16 design software or one of several other commercially available JEDEC standard PLD design software packages.

FEATURES

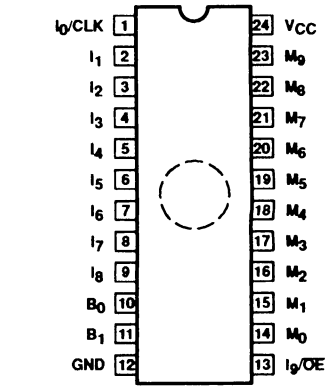
- **High-speed EPROM-based CMOS Multi-Function PLD**
  - **Super set of 22V10, 32VX10 and 20RA10 PAL® ICs**
- **Two fully programmable arrays eliminate "P-term Depletion"**
  - **Up to 64 P-terms per OR function**
- **Improved output macro cell structure**
  - **Individually programmable as:**
    - *** Registered output with feedback**
    - *** Registered input**
    - *** Combinatorial I/O with buried register**
  - **Bypassed registers are 100% functional with separate input and feedback paths**
  - **Individual Output Enable control functions**
    - *** From pin or AND array**
- **Eleven clock sources**
- **Register preload and diagnostic test mode features**
- **Security fuse**

APPLICATIONS

- **Mealy or Moore State Machines**
  - **Synchronous**
  - **Asynchronous**
- **Multiple, independent State Machines**
- **10-bit ripple cascade**
- **Sequence recognition**
- **Bus protocol generation**
- **Industrial control**
- **A/D scanning**

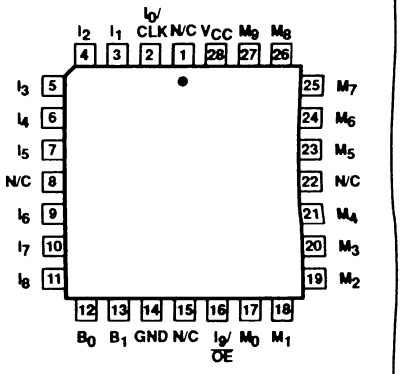
PIN CONFIGURATIONS

FA and N Packages



N = Plastic
FA = Ceramic with Quartz Window

A Package



A = Plastic Leaded Chip Carrier

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PLC18V8Z25/35/18V8ZI – Zero Standby Power Universal PAL®-Type Devices

DESCRIPTION

The PLC18V8Z35 and PLC18V8ZI are universal PAL-type devices featuring high performance and virtually zero-standby power for power sensitive applications. They are reliable, user-configurable substitutes for discrete TTL/CMOS logic. While compatible with TTL and HCT logic, the PLC18V8ZI can also replace HC logic over the V_{CC} range of 4.5 to 5.5V.

The PLC18V8Z is a two-level logic element comprised of 10 inputs, 74 AND gates (product terms) and 8 output Macro cells.

Each output features an "Output Macro Cell" which can be individually configured as a dedicated input, a combinatorial output, or a registered output with internal feedback. As a result, the PLC18V8Z is capable of emulating all common 20-pin PAL devices to reduce documentation, inventory, and manufacturing costs.

A power-up reset function and a Register Preload function have been incorporated in the PLC18V8Z architecture to facilitate state machine design and testing.

With a standby current of less than 100µA and active power consumption of 1.5mA/MHz, the PLC18V8Z is ideally suited for power sensitive applications in battery operated/backed portable instruments and computers.

The PLC18V8Z is also processed to industrial requirements for operation over an extended temperature range of -40°C to +85°C and supply voltage of 4.5V to 5.5V.

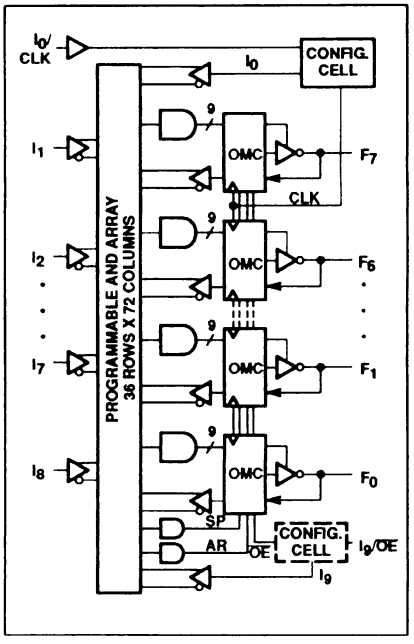
FEATURES

- **20-pin Universal Programmable Array Logic**
- **Virtually zero standby power**
- **Functional replacement for Series 20 PAL devices**
  - **I_{OL} = 24mA**
- **High-performance CMOS EPROM cell technology**
  - **Erasable**
  - **Reconfigurable**
  - **100% testable**
- **25/35ns propagation delay (comm)**
- **25/40ns propagation delay (Industrial)**
- **Up to 18 inputs and 8 input/output macro cells**
- **Programmable output polarity**
- **Power-up reset on all registers**
- **Register preload capability**
- **Synchronous Preset/Asynchronous Reset**
- **Security fuse to prevent duplication of proprietary designs**
- **Design support provided using Signetics SLICE or SIMPALII software development packages and other CAD tools for PLDS**
- **Available in 300mil-wide DIP with quartz window, plastic DIP (OTP) or PLCC (OTP)**

APPLICATIONS

- **Battery powered instruments**
- **Laptop and pocket computers**
- **Industrial control**
- **Medical Instruments**
- **Portable communications equipment**

FUNCTIONAL DIAGRAM



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PLUS405-37/-45/-55 – Field-Programmable Logic Sequencers (16 × 64 × 8)

DESCRIPTION

The PLUS405 devices are bipolar, programmable state machines of the Mealy type. Both the AND and the OR array are user-programmable. All 64 AND gates are connected to the 16 external dedicated inputs (I_0 - I_{15}) and to the feedback paths of the 8 on-chip State Registers (Q_{P0} - Q_{P7}). Two complement arrays support complex IF-THEN-ELSE state transitions with a single product term (input variables C_0, C_1).

All state transition terms can include True, False and Don't Care states of the controlling state variables. All AND gates are merged into the programmable OR array to issue the next-state and next-output commands to their respective registers. Because the OR array is programmable, any one or all of the 64 transition terms can be connected to any or all of the State and Output Registers.

All state (Q_{P0} - Q_{P7}) and output (Q_{F0} - Q_{F7}) registers are edge-triggered, clocked J-K flip-flops, with Asynchronous Preset and Reset options. The PLUS405 architecture provides the added flexibility of the J-K toggle function which is indeterminate on S-R flip-flops. Each register may be individually programmed such that a specific Preset-Reset pattern is initialized when the initialization pin is raised to a logic level "1". This feature allows the state machine to be asynchronously initialized to known internal state and output conditions prior to proceeding through a sequence of state transitions. Upon power-up, all registers are unconditionally preset to "1". If desired, the initialization input pin (INIT) can be converted to an Output Enable ($\overline{OE}$) function as an additional user-programmable feature.

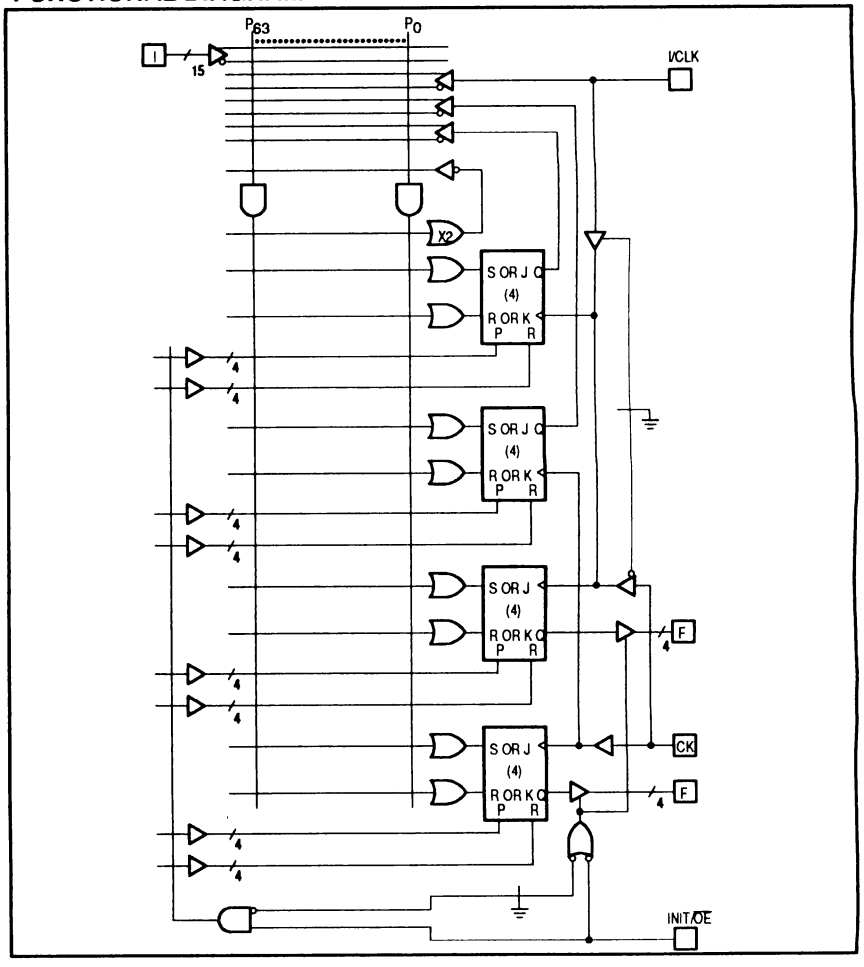
FEATURES

- **50, 58 and 62.5MHz minimum guaranteed clock rates**
- **37, 45 and 55MHz minimum guaranteed operating frequencies ($1/(t_{S1} + t_{CKO1})$)**
- **Field-programmable (Ti-W fusible link)**
- **8 output functions**
- **64 transition terms**
- **8-bit Output Register**
- **2 transition Complement Arrays**
- **Multiple clocks**
- **"On-chip" diagnostic test mode features for access to state and output registers**
- **950mW power dissipation (typ.)**
- **TTL compatible**
- **Automatic "Hold" states**
- **3-State outputs**

APPLICATIONS

- **Interface protocols**
- **Sequence detectors**
- **Peripheral controllers**
- **Timing generators**
- **Sequential circuits**
- **Elevator contollers**
- **Security locking systems**
- **Counters**
- **Shift registers**

FUNCTIONAL DIAGRAM



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Cellular Radio Chip Set

UMA1000/10/12/14 NE605/5750/5751 PCF8282/8XC552

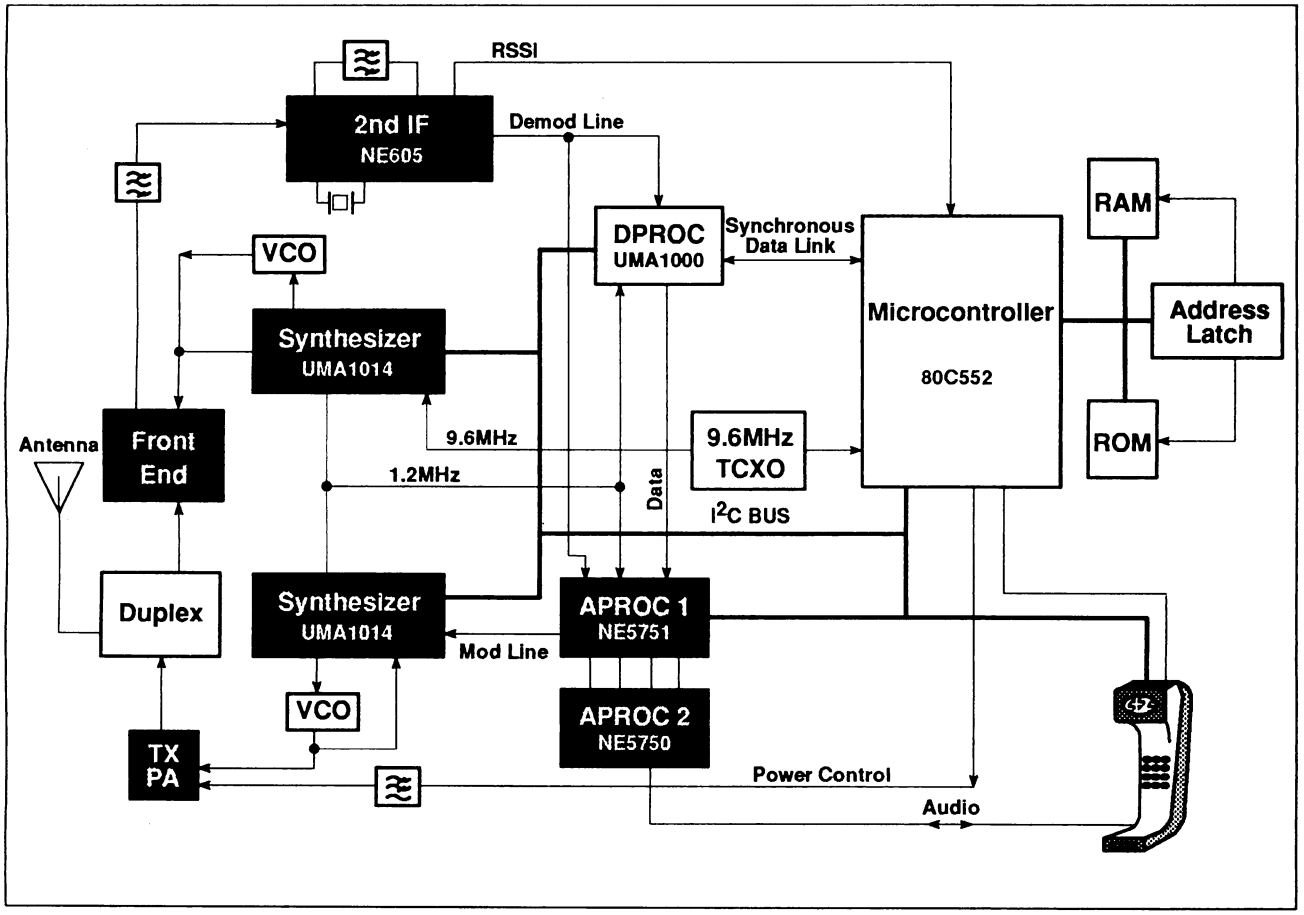
COMPONENTS

- **NE605 – Low Power Single Chip FM System**
- **NE5750 – Audio Processor - Companding and Amplifier**
- **NE5751 – Audio Processor - Filter and Control Section**
- **UMA1000 – Data Processor for Cellular Radio**
- **UMA1014 – Low-Power Universal Synthesizer for Radio Communication**
- **S80C552 – Single Chip 8-Bit Microcontroller with A/D, Capture/ Compare Timer, with High-Speed Outputs, PWM**

FEATURES

- **6 key ICs for maximum integration**
- **Integrated filters, amplifiers, and compandors to reduce off-chip components**
- **Designed for minimum current consumption, i.e., maximum use of standby modes, low current IC design**
- **I^2C serial control bus**

CELLULAR RADIO CHIP SET SCHEMATIC



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NE/SA606 – Low Voltage High-Performance Mixer FM IF System

DESCRIPTION

The NE/SA606 is a high performance monolithic low-power FM IF system incorporating a mixer/oscillator, two limiting intermediate frequency amplifiers, quadrature detector, logarithmic received signal strength indicator (RSSI), voltage regulator, audio and RSSI op amps. The NE/SA606 is available in 20-lead dual-in-line plastic, 20-lead SOL (surface-mounted miniature package) and 20-lead SSOP package.

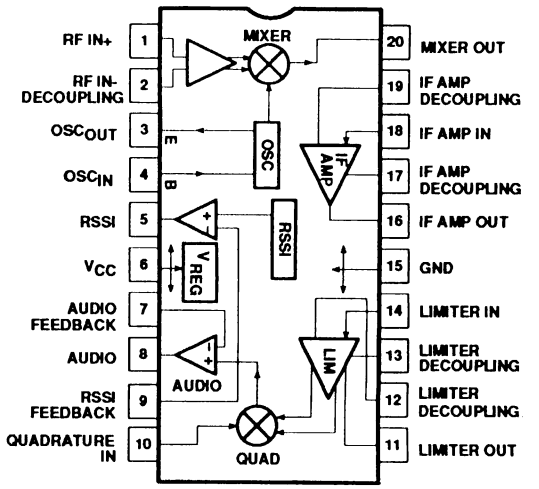
The NE606 was designed for portable communication applications and will function down to 2.85V. The RF section is similar to the famous NE605. The audio and RSSI outputs have amplifiers with access to the feedback path. This enables the designer to level adjust the outputs or add filtering.

FEATURES

- **Low power consumption: 3.5mA typical at 3V**
- **Mixer input to >150MHz**
- **Mixer conversion power gain of 12dB at 45MHz**
- **XTAL oscillator effective to 150MHz (L.C. oscillator or external oscillator can be used at higher frequencies)**
- **102dB of IF Amp/Limiter gain**
- **2MHz limiter small signal bandwidth**
- **Temperature compensated logarithmic Received Signal Strength Indicator (RSSI) with a 90dB dynamic range**
- **Low external component count; suitable for crystal/ceramic/LC filters**
- **Excellent sensitivity: 0.31μV into 50Ω matching network for 12dB SINAD (Signal to Noise and Distortion ratio) for 1kHz tone with RF at 45MHz and IF at 455kHz**
- **SA606 meets cellular radio specifications**
- **Audio output internal op amp**
- **RSSI output internal op amp**
- **Internal op amps with rail-to-rail outputs**

PIN CONFIGURATION

D, DK and N Packages



APPLICATIONS

- **Portable cellular radio FM IF**
- **Cordless telephones**
- **RF level meter**
- **Spectrum analyzer**
- **Instrumentation**
- **FSK and ASK data receivers**
- **Log amps**
- **High performance communication receiver**
- **Single conversion VHF receivers**
- **Wireless systems**

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NE/SA607 – Low Voltage High-Performance Mixer FM IF System

DESCRIPTION

The NE/SA607 is a high performance monolithic low-power FM IF system incorporating a mixer/oscillator, two limiting intermediate frequency amplifiers, quadrature detector, logarithmic received signal strength indicator (RSSI), voltage regulator, audio and RSSI op amps. The NE/SA607 is available in 20-lead dual-in-line plastic, 20-lead SOL (surface-mounted miniature package) and 20-lead SSOP package.

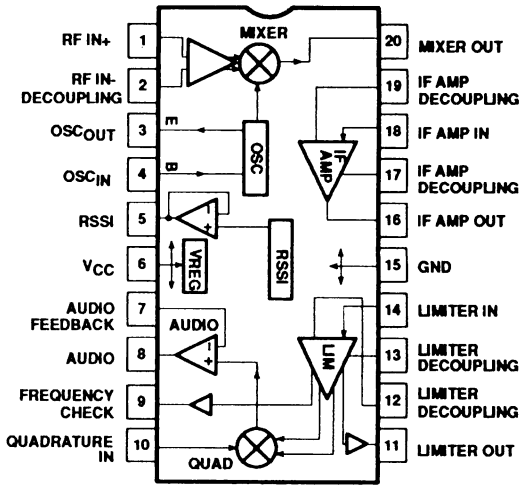
The NE607 was designed for portable communication applications and will function down to 2.85V. The RF section is similar to the famous NE605. The audio output has an internal amplifier with the feedback pin accessible. The RSSI output is buffered. The NE607 also has an extra limiter output. This signal is buffered from the output of the limiter and can be used to perform frequency check. This is accomplished by comparing a reference frequency with the frequency check signal using a comparator to a varactor or PLL at the oscillator inputs.

FEATURES

- **Low power consumption: 3.5mA typical at 3V**
- **Mixer input to >150MHz**
- **Mixer conversion power gain of 12dB at 45MHz**
- **XTAL oscillator effective to 150MHz (L.C. oscillator or external oscillator can be used at higher frequencies)**
- **102dB of IF Amp/Limiter gain**
- **2MHz limiter small signal bandwidth**
- **Temperature compensated logarithmic Received Signal Strength Indicator (RSSI) with a 90dB dynamic range**
- **Low external component count; suitable for crystal/ceramic/LC filters**
- **Excellent sensitivity: 0.31μV into 50Ω matching network for 12dB SINAD (Signal to Noise and Distortion ratio) for 1kHz tone with RF at 45MHz and IF at 455kHz**
- **SA607 meets cellular radio specifications**
- **Audio output internal op amp**
- **RSSI output internal op amp**
- **Internal op amps with rail-to-rail outputs**
- **Buffered frequency check output**

PIN CONFIGURATION

D, DK and N Packages



APPLICATIONS

- **Portable cellular radio FM IF**
- **Cordless telephones**
- **RF level meter**
- **Spectrum analyzer**
- **Instrumentation**
- **FSK and ASK data receivers**
- **Log amps**
- **Low voltage high performance communication receiver**
- **Single conversion VHF receivers**
- **Wireless systems**

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NE/SA575 – Low Voltage Compandor

FEATURES

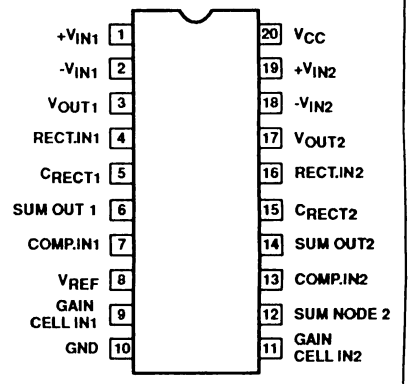
- Operating voltage range from 3V to 7V
- Reference voltage of 100mV$_{RMS}$ = 0dB
- One dedicated summing op amp per channel and two extra uncommitted op amps
- 600Ω drive capability
- Single or split operation
- Wide input/output swing capability
- Available in SSOP

APPLICATIONS

- Portable communications
- Cellular radio
- Cordless telephone
- Consumer audio
- Portable broadcast mixers
- Wireless microphones
- Modems
- Electric organs
- Hearing aids

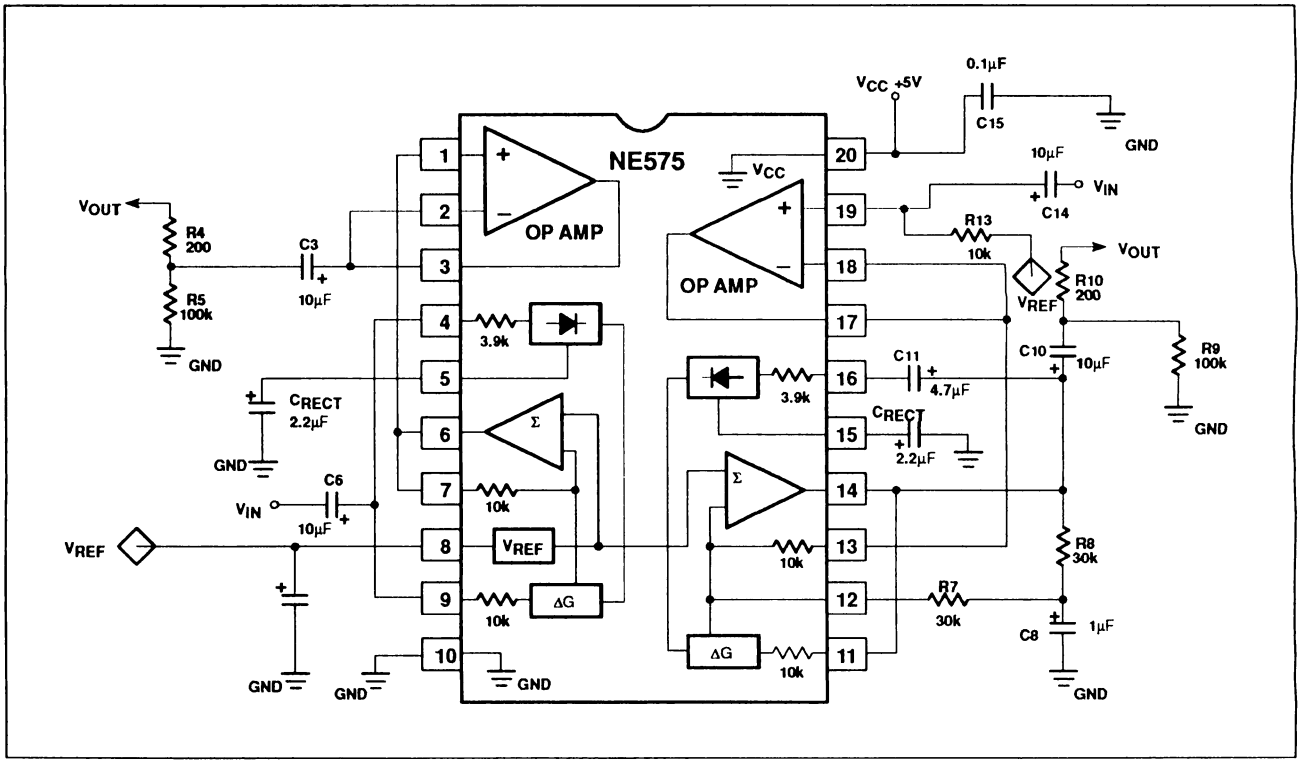
PIN CONFIGURATION

D[1], D[2], DK[2] and N Packages



NOTES:
1. Available in large SOL package.
2. Available in Shrink Small Outline Package (SSOP).

BLOCK DIAGRAM AND TEST CIRCUIT



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NE/SA577 – Unity Gain Level Programmable Low Power Compandor

DESCRIPTION

The NE/SA577 is a unity gain level programmable compandor designed for low power applications. The NE577 is internally configured as an expandor and a compressor to minimize external component count.

The NE577 is available in a 14-pin plastic DIP and an SO package.

FEATURES

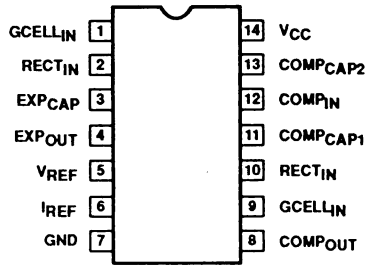
- **Operating voltage range: 1.8V to 7V**
- **Low power consumption (1.4mA @ 3.6V)**
- **0dB level programmable(10mV$_{RMS}$ to 1.0V$_{RMS}$)**
- **Over 90dB of dynamic range**
- **Wide input/output swing capability (rail-to-rail)**
- **Low external component count**
- **SA577 meets cellular radio specifications**
- **ESD hardened**

APPLICATIONS

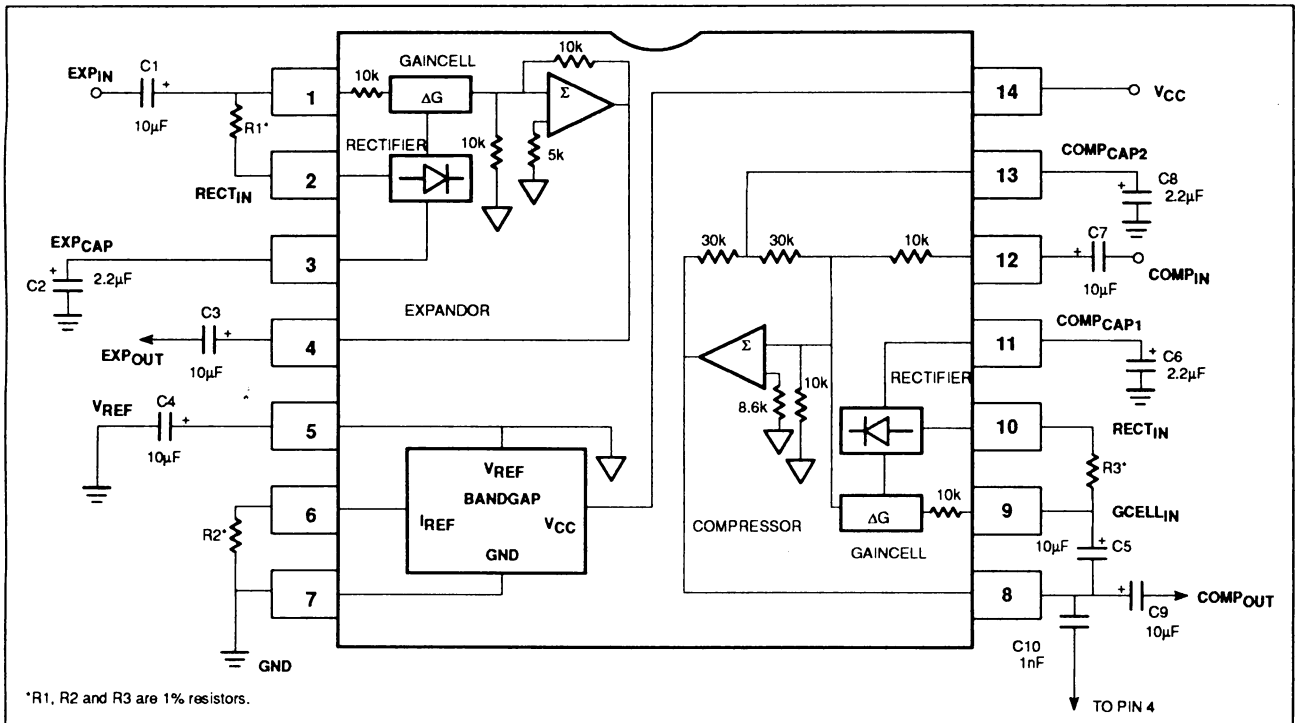
- **High performance portable communications**
- **Cellular radio**
- **Cordless telephone**
- **Consumer audio**
- **Wireless microphones**
- **Modems**
- **Electric organs**
- **Hearing aids**
- **Automatic level control (ALC)**

PIN CONFIGURATION

D and N Packages



BLOCK DIAGRAM AND TEST CIRCUIT



*R1, R2 and R3 are 1% resistors.

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NE/SA578 – Unity Gain Level Programmable Low Power Compandor

DESCRIPTION

The NE/SA578 is a unity gain level programmable compandor designed for low power applications. The NE578 is internally configured as an expandor and a compressor to minimize external component count.

The summing amplifiers of the NE578 have 600Ω drive capability and the inverting input of the compressor amplifier is accessible through Pin 9 for summing multiple external signals. Power Down/Mute function is active low and requires an open collector output logic configuration at Pin 8. If Power Down/Mute is not needed, Pin 8 should be left open. When the part is muted, supply current drops to 170μA at 3.6V.

The NE578 is available in a 16-pin plastic DIP and an SO package.

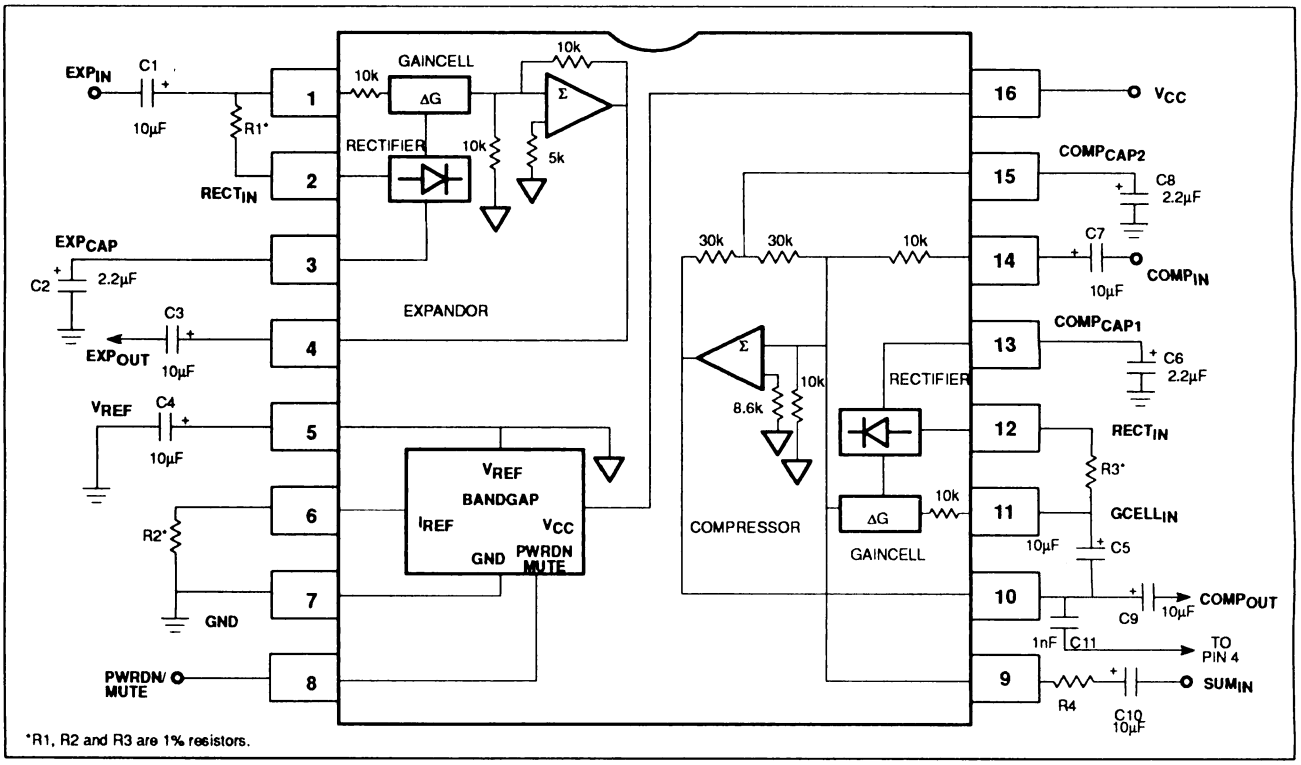
FEATURES

- **Operating voltage range: 1.8V to 7V**
- **Low power consumption (1.4mA @ 3.6V)**
- **0dB level programmable(10mV$_{RMS}$ to 1.0V$_{RMS}$)**
- **Over 90dB of dynamic range**
- **Wide input/output swing capability**
- **Low external component count**
- **SA578 meets cellular radio specifications**
- **ESD hardened**
- **Power Down mode (I$_{CC}$ = 170μA @ 3.6V)**
- **Mute function**
- **Multiple external summing capability**
- **600Ω drive capability**

APPLICATIONS

- **High performance portable communications**
- **Cellular radio**
- **Cordless telephone**
- **Consumer audio**
- **Wireless microphones**
- **Modems**
- **Electric organs**
- **Hearing aids**
- **Automatic level control (ALC)**

NE/SA578 – BLOCK DIAGRAM AND TEST AND APPLICATION CIRCUIT



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NE/SA5209 – Wideband Variable Gain Amplifier

DESCRIPTION

The NE5209 represents a breakthrough in monolithic amplifier design featuring several innovations. This unique design has combined the advantages of a high speed bipolar process with the proven Gilbert architecture.

The NE5209 is a linear broadband RF amplifier whose gain is controlled by a single DC voltage. The amplifier runs off a single 5 volt supply and consumes only 40mA. The amplifier has high impedance (1kW) differential inputs. The output is 50W differential. Therefore, the 5209 can simultaneously perform AGC, impedance transformation, and the balun functions.

The dynamic range is excellent over a wide range of gain setting. Furthermore, the noise performance degrades at a comparatively slow rate as the gain is reduced. This is an important feature when building linear AGC systems.

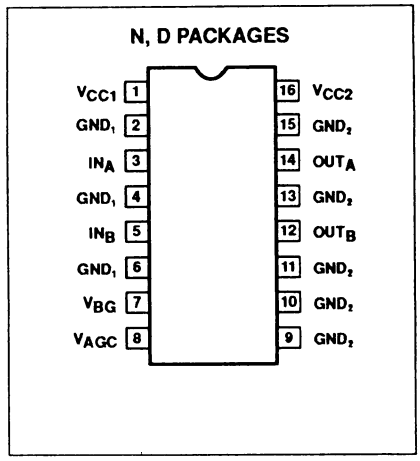
FEATURES

- **Gain to 1.5GHz**
- **850MHz bandwidth**
- **High impedance differential input**
- **50Ω differential output**
- **Single 5V power supply**
- **0 - 1V gain control pin**
- **>60dB gain control range at 200MHz**
- **26dB maximum gain differential**
- **Exceptional $V_{CONTROL}/V_{GAIN}$ linearity**
- **7dB noise figure minimum**
- **Full ESD protection**
- **Easily cascadable**

APPLICATIONS

- **Linear AGC systems**
- **Very linear AM modulator**
- **RF balun**
- **Cable TV multi–purpose amplifier**
- **Fiber optic AGC**
- **RADAR**
- **Cellular communications**

PIN CONFIGURATION



- **User programmable fixed gain block**
- **Video**
- **Satellite receivers**

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Ethernet Transceivers NE8392A, NE86C92

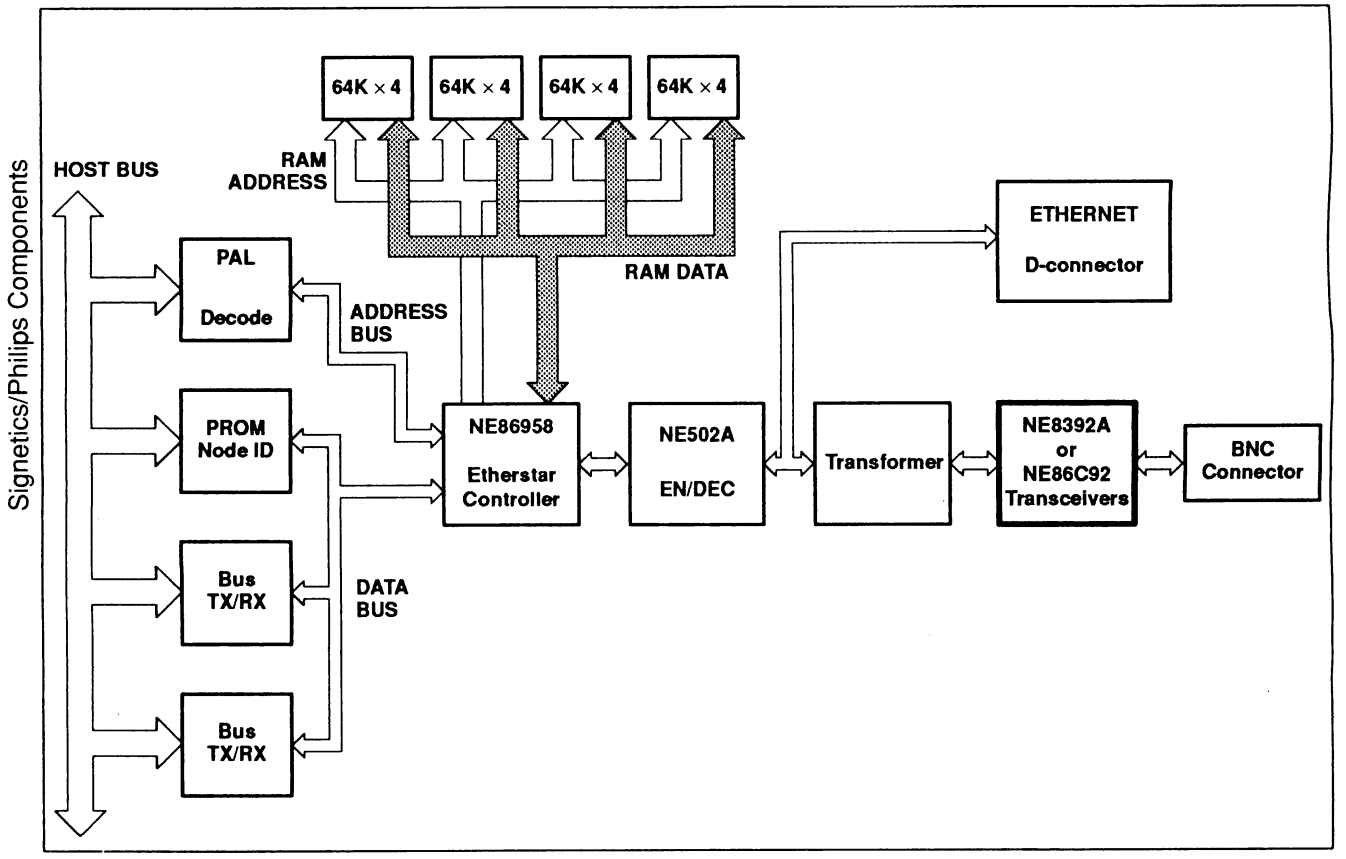
NE8392A – COAXIAL TRANSCEIVER INTERFACE

- Compatible with Ethernet II, IEEE 802.3 10base5 and 10base2, and ISO 8802/3 interface specifications
- Integrates all transceiver electronics except signal and power isolation
- Heartbeat generator can be externally disabled for operation as IEEE 802.3 compatible repeaters
- Full ESD protection
- Power-on reset prevents glitches on coaxial cable during power up.
- Standard 16-pin DIP with special lead frame minimizes the operating die temperature

NE86C92 – TWISTED-PAIR TRANSCEIVER INTERFACE

- Compatible with IEEE 802.3 10BASE-T specifications
- Integrates all transceiver functions, with selectable heartbeat and link test generators
- Twisted-pair polarity detection and automatic correction
- Smart squelch on all data inputs
- Internal transmitter pre-distortion generator
- Supports automatic selection between AUI and RJ-45 connections
- Five LED status signals with on-chip drivers for transmit, receive and link integrity, collision, jabber status and twisted pair polarity reversal
- Advanced CMOS process uses single 5V supply
- Extremely low power operation: 24mA typical idle current

TYPICAL BOARD COMPONENTS FOR ETHERNET CARD



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SCN68562/SCN26562 – Dual Universal Serial Communications Controller (DUSCC)

GENERAL FEATURES

- SCN26562 is fully compatible with Intel
- SCN68562 is fully compatible with Motorola
- Dual full-duplex synchronous/asynchronous receiver and transmitter
- Multiprotocol operation
  - BOP: HDLC/ADCCP, SDLC loop, X.25 or X.75 link level, etc.
  - COP: BISYNC, DDCMP
  - ASYNC: 5 - 8 bits plus optional parity
- Four character receiver and transmitter FIFOs
- 0 to 4MHz data rate
- Programmable bit rate for each receiver and transmitter selectable from:
  - 16 fixed rates: 50 to 38.4k baud
  - One user-defined rate derived from programmable counter/timer
  - External 1X or 16X clock
  - Digital phase-locked loop
- Programmable data transfer mode: polled, interrupt, DMA, wait
- DMA interface
  - Compatibe with Signetics' SCB68430 Direct Memory Access Interface (DMAI) and other DMA controllers
  - Half- or full-duplex operation
  - Single or dual address data transfers
  - Automatic frame termination on counter/timer terminal count or DMA DONE
- Interrupt capabilities
  - Daisy chain option
  - Vector output (fixed or modified by status)
  - Programmable internal priorities
  - Maskable interrupt conditions
- Multifunction programmable 16-bit counter/timer
  - Bit rate generator
  - Event counter
  - Count received or transmitted characters
  - Delay generator
  - Automatic bit length measurement
- Modem controls
  - RTS, CTS, DCD, and up to four general purpose I/O pins per channel
  - CTS and DCD programmable autoenables for Tx and Rx
  - Programmable interrupt on change of CTS or DCD

ASYNCHRONOUS MODE FEATURES

- Character length: 5 to 8 bits
- Odd or even parity, no parity, or force parity
- Up to two stop bits programmable in 1/16-bit increments
- 1X or 16X Rx and Tx clock factors
- Parity, overrun, and framing error detection
- False start bit detection
- Start bit search 1/2 bit time after framing error detection
- Break generation with handshake for counting break characters
- Detection of start and end of received break

CHARACTER-ORIENTED PROTOCOL FEATURES

- Character length: 5 to 8 bits
- Odd or even parity, no parity, or force parity
- LRC or CRC generation and checking
- Optional opening PAD transmission
- SYN detection and optional stripping
- SYN or MARK linefill on underrun
- Parity, FCS, overrun, and underrun error detection
- BISYNC Features
  - EBCDIC or ASCII header, test and control messages
  - SYN, DLE stripping
  - EOM (End Of Message) detection and transmission
  - Auto transparency mode switching
  - Auto hunt after receipt of EOM sequence (with closing PAD check after EOT or NAK)

BIT-ORIENTED PROTOCOL FEATURES

- Character length: 5 to 8 bits
- Detection and transmission of residual character: 0 - 7 bits
- Automatic switch to programmed character length for 1 field
- Zero insertion and deletion
- Optional opening PAD transmission
- ABORT, ABORT-FLAGs, or FCS-FLAGs line fill on underrun
- Extended address and control fields
- CRC generation and checking
- SDLC loop mode capability

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SC26C94/68C94 – Quad Universal Asynchronous Receiver/Transmitter (QUART)

FEATURES

- Four Signetics industry-standard UARTs
- Eight byte receive FIFOs for each UART
- Programmable data format:
  - 5 to 8 data bits plus parity
  - Odd, even, no parity or force parity
  - 1, 1.5 or 2 stop bits programmable in 1/16-bit increments
- Baud rate for the receiver and transmitter selectable from:
  - 18 fixed rates: 50 to 38.4K baud Non-standard rates to 230.4K baud
  - User-defined rates from the programmable counter/timer associated with each of two blocks
  - External 1x or 16x clock
- Parity, framing, and overrun error detection
- False start bit detection
- Line break detection and generation
- Programmable channel mode
  - Normal (full-duplex), automatic echo, local loop back, remote loopback
- Eight byte transmit FIFOs for each UART
- Programmable interrupt priorities
- Identification of highest priority interrupt
- Global interrupt register set provides data from interrupting channel
- Vectored interrupts with programmable vector format
- IACKN and DTACKN signals
- Built-in baud rate generator with choice of 18 rates
- Four I/O pins per UART for modem controls, clocks, etc.
- Power down mode
- High-speed CMOS technology
- 52-pin PLCC and 48-pin DIP
- Commercial and industrial temperature ranges available
- On-chip crystal oscillator
- TTL compatible
- Single +5V power supply with low power mode
- Two multifunction programmable 16-bit counter/timers
- 1MHz 16x mode operation
- 30ns data bus release time
- "Watch Dog" timer for each receiver

Signetics/Philips Components

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SCC68692 – Dual Asynchronous Receiver/Transmitter (DUART)

DESCRIPTION

The Signetics SCC68692 Dual Universal Asynchronous Receiver/Transmitter (DUART) is a single-chip CMOS-LSI communications device that provides two full-duplex asynchronous receiver/transmitter channels in a single package. It is compatible with other S68000 family devices and can also interface easily with other microprocessors. The DUART can be used in a polled or interrupt driven systems.

The operating mode and data format of each channel can be programmed independently. Additionally, each receiver and transmitter can select its operating speed as one of eighteen fixed baud rates, a 16X clock derived from a programmable counter/timer, or an external 1X or 16X clock. The baud rate generator and counter/timer can operate directly from a crystal or from external clock inputs. The ability to independently program the operating speed of the receiver and transmitter make the DUART particularly attractive for dual- speed channel applications such as clustered terminal systems.

Each receiver is quadruple buffered to minimize the potential of receiver over-run or to reduce interrupt overhead in interrupt driven systems. In addition, a flow control capability is provided to disable a remote DUART transmitter when the receiver buffer is full.

Also provided on the SCC68692 are a multipurpose 6-bit input port and a multipurpose 8-bit output port. These can be used as general purpose I/O ports or can be assigned specific functions (such as clock inputs or status/interrupt outputs) under program control.

FEATURES

- **S68000 bus compatible**
- **Dual full-duplex asynchronous receiver/transmitters**
- **Quadruple buffered receiver data register**
- **Programmable data format:**
  - **5 to 8 data bits plus parity**
  - **Odd, even, no parity or force parity**
  - **1, 1.5 or 2 stop bits programmable in 1/16-bit increments**
- **Programmable baud rate for each receiver and transmitter selectable from:**
  - **18 fixed rates: 50 to 38.4K baud**
  - **One user-defined rate derived from programmable counter/timer**
  - **External 1X or 16X clock**
- **Parity, framing, and overrun error detection**
- **False start bit detection**
- **Line break detection and generation**
- **Programmable channel mode**
  - **Normal (full-duplex)**
  - **Automatic echo**
  - **Local loopback**
  - **Remote loopback**
- **Multi-function 6-bit input port**
  - **Can serve as clock or control inputs**
  - **Change of state detection on four inputs**
- **Multi-function 8-bit output port**
  - **Individual bit set/reset capability**
  - **Outputs can be programmed to be status/interrupt signals**
- **Versatile interrupt system**
  - **Single interrupt output with eight maskable interrupting conditions**
  - **Interrupt vector output on interrupt acknowledge**
  - **Output port can be configured to provide a total of up to six separate wire-ORable interrupt outputs**
- **Maximum data transfer rates: 1X – 1Mb/s, 16X – 125Kb/s**
- **Automatic wake-up mode for multidrop applications**
- **Start-end break interrupt/status**
- **Detects break which originates in the middle of a character**
- **On-chip crystal oscillator**
- **Power down mode**
- **Receiver timeout mode**
- **Commercial and Industrial temperature range versions**
- **TTL compatible**
- **Single +5V power supply**

Signetics

Philips Semiconductors

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SCC2692 – Dual Asynchronous Receiver/Transmitter (DUART)

DESCRIPTION

The Signetics SCC2692 Dual Universal Asynchronous Receiver/Transmitter (DUART) is a single-chip CMOS-LSI communications device that provides two full-duplex asynchronous receiver/transmitter channels in a single package. It interfaces directly with microprocessors and may be used in a polled or interrupt driven system.

The operating mode and data format of each channel can be programmed independently. Additionally, each receiver and transmitter can select its operating speed as one of eighteen fixed baud rates, a 16X clock derived from a programmable counter/timer, or an external 1X or 16X clock. The baud rate generator and counter/timer can operate directly from a crystal or from external clock inputs. The ability to independently program the operating speed of the receiver and transmitter make the DUART particularly attractive for dual- speed channel applications such as clustered terminal systems.

Each receiver is quadruply buffered to minimize the potential of receiver overrun or to reduce interrupt overhead in interrupt driven systems. In addition, a flow control capability is provided to disable a remote DUART transmitter when the receiver buffer is full.

Also provided on the SCC2692 are a multipurpose 7-bit input port and a multipurpose 8-bit output port. These can be used as general purpose I/O ports or can be assigned specific functions (such as clock inputs or status/interrupt outputs) under program control.

The SCC2692 is available in three package versions: 40-pin and 28-pin, 0.6" wide, DIPs and a 44-pin PLCC.

FEATURES

- **Dual full-duplex asynchronous receiver/transmitters**
- **Quadruple buffered receiver data register**
- **Programmable data format**
  - **5 to 8 data bits plus parity**
  - **Odd, even, no parity or force parity**
  - **1, 1.5 or 2 stop bits programmable in 1/16-bit increments**
- **Programmable baud rate for each receiver and transmitter selectable from:**
  - **18 fixed rates: 50 to 38.4k baud**
  - **One user-defined rate derived from programmable counter/timer**
  - **External 1X or 16X clock**
- **Parity, framing, and overrun error detection**
- **False start bit detection**
- **Line break detection and generation**
- **Programmable channel mode**
  - **Normal (full-duplex)**
  - **Automatic echo**
  - **Local loopback**
  - **Remote loopback**
- **Multi-function 7-bit input port**
  - **Can serve as clock or control inputs**
  - **Change of state detection on four inputs**
- **Multi-function 8-bit output port**
  - **Individual bit set/reset capability**
  - **Outputs can be programmed to be status/interrupt signals**
- **Versatile interrupt system**
  - **Single interrupt output with eight maskable interrupting conditions**
  - **Output port can be configured to provide a total of up to six separate wire-ORable interrupt outputs**
- **Maximum data transfer rates: 1X - 1Mb/s, 16X - 125Kb/s**
- **Automatic wake-up mode for multidrop applications**
- **Start-end break interrupt/status**
- **Detects break which originates in the middle of a character**
- **On-chip crystal oscillator**
- **Power down mode**
- **Receiver timeout mode**
- **Commercial and industrial temperature range versions**
- **TTL compatible**
- **Single +5V power supply**

Signetics/Philips Components

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SCC2698B – Enhanced Octal Universal Asynchronous Receiver/Transmitter (DUART)

DESCRIPTION

The SCC2698B Enhanced Octal Universal Asynchronous Receiver/ Transmitter (Octal UART) is a single chip MOS-LSI communications device that provides eight full-duplex asynchronous receiver/transmitter channels in a single package. It is fabricated with CMOS technology which combines the benefits of high density and low power consumption.

The operating speed of each receiver and transmitter can be selected independently as one of eighteen fixed baud rates, a 16X clock derived from a programmable counter/timer, or an external 1X or 16X clock. The baud rate generator and counter/timer can operate directly from a crystal or from external clock inputs. The ability to independently program the operating speed of the receiver and transmitter make the Octal UART particularly attractive for dual-speed channel applications such as clustered terminal systems.

The receiver is quadruple buffered to minimize the potential of receiver overrun or to reduce interrupt overhead in interrupt driven systems. In addition, a handshaking capability is provided to disable a remote UART transmitter when the receiver buffer is full.

The UART provides a power-down mode in which the oscillator is frozen but the register contents are stored. This results in reduced power consumption on the order of several magnitudes. The Octal UART is fully TTL compatible and operates from a single +5V power supply.

The SCC2698B is an upwardly compatible version of the 2698A Octal UART. In PLCC packaging, it is enhanced by the addition of receiver ready or FIFO full status outputs, and transmitter empty status outputs for each channel on 16 multipurpose I/O pins. The multipurpose I/O pins of the SCC2698B were inputs only on the SCC2698A.

FEATURES

- **Eight full-duplex asynchronous receiver/transmitters**
- **Quadruple buffered receiver data register**
- **Programmable data format:**
  - **5 to 8 data bits plus parity**
  - **Odd, even, no parity or force parity**
  - **1, 1.5 or 2 stop bits programmable in 1/16-bit increments**
- **Baud rate for the receiver and transmitter selectable from:**
  - **18 fixed rates: 50 to 38.4K baud Non-standard rates to 115.2K baud**
  - **User-defined rates from the programmable counter/timer associated with each of four blocks**
  - **External 1X or 16X clock**
- **Parity, framing, and overrun error detection**
- **False start bit detection**
- **Line break detection and generation**
- **Programmable channel mode**
  - **Normal (full-duplex), automatic echo, local loop back, remote loopback**
- **Four multi-function programmable 16-bit counter/timers**
- **Four interrupt outputs with eight maskable interrupting conditions for each output**
- **Receiver ready/FIFO full and transmitter ready status available on 16 multi-function pins in PLCC package**
- **On-chip crystal oscillator**
- **TTL compatible**
- **Single +5V power supply with low power mode**

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NE/SA5234 – Matched Quad High-Performance Low-Voltage Operational Amplifier

DESCRIPTION

The NE/SA5234 is a matched, low voltage, high performance quad operational amplifier. Among its unique input and output characteristics is the capability for both input and output rail-to-rail operation, particularly critical in low voltage applications. The output swings to less than 50mV of both rails across the entire power supply range.

The NE/SA5234 is capable of delivering 5.5V peak-to-peak across a 600Ω load and will typically draw only 700μA per amplifier. The bandwidth is 2.5MHz and the 1% settling time is 1.4μs.

FEATURES

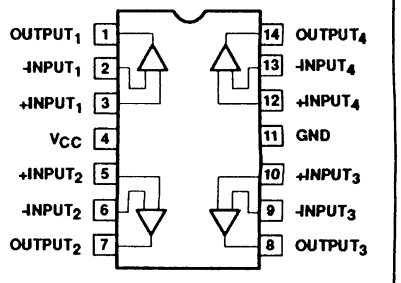
- **Wide common-mode input voltage range: 250mV beyond both rails**
- **Output swing within 50mV of both rails**
- **Functionality to 1.8V typical**
- **Low current consumption: 700μA per amplifier**
- **±15mA output current capability**
- **Unity gain bandwidth 2.5MHz**
- **Slew rate: 0.8V/μS**
- **Low noise: 25nV/√Hz**
- **Electrostatic discharge protection**
- **Short-circuit protection**
- **Output inversion prevention**

APPLICATIONS

- **Automotive electronics**
- **Signal conditioning and sensing amplification**
- **Portable instrumentation**
  - **Test and measurement**
  - **Medical monitors and diagnostics**
  - **Remote meters**
- **Audio equipment**
- **Security systems**
- **Communications**

PIN CONFIGURATION

N, and D PACKAGES



Signetics/Philips Components

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Siliconix

Power ICs

Siliconix's power ICs are designed to solve specific customer needs in power-supply and motion-control applications in such areas as telecommunications equipment, portable computers, printers and plotters, battery operated tools, automotive electrical systems, and fractional horsepower motors. We are also a leader in power MOSFET technology, and we specifically develop MOSFETs that will maximize system performance when used in combination with our power ICs.

Telecommunications Equipment

Our PWM regulator and controller ICs were originally designed and developed for use in telecommunications equipment, and later, this IC family was expanded for use in universal-input applications and battery-operated equipment. For low-power dc-to-dc conversion, these regulators and controllers offer the industry's most efficient solutions. They have been widely used in such areas as feature telephones, line cards for switching exchange systems, ISDN terminals, and digital phone systems.

Computer and Industrial Power Supplies

The Si9120 PWM controller is specifically designed for universal-input power supplies and ac battery adaptors, and the Si9112 provides the ideal solution for portable computers and other battery operated equipment where high efficiency is a must.

VCM Driver

Part No.	Functional Description	Peak Output Current (A)	Supply Voltage (V)	Target Application	Package Type
Si9961CY	Transconductance Amplifier for Voice Coil Motors	1	12	Hard Disk Drives & Optical Disk Drives	24-Pin SOIC

MOSFET Drivers

Part No.	Functional Description	Peak Output Current (A)	Target Application	Package Type
D469AAP	Quad CMOS Driver with Complementary Inputs	1.5	Motor Drives & Power Supplies	14-Pin Ceramic DIP
D469ADJ		1.5		14-Pin Plastic DIP
Si9910DJ	Adaptive High-Low-Side Drivers with Protection Features	1.0	Motor Drives & UPS	8-Pin Plastic DIP
Si9910DY		1.0		8-Pin SOIC
Si9976DY	N-Channel Half-Bridge Driver with 20 to 40-V Supply Range	0.5	Motor Drives	14-Pin SOIC

CMOS PWM ICs

Part No.	Functional Description*	Operating Range (V)	Target Market Segment	Package Type
Si9100DJ	3 W Regulator	10 to 70	Telecom	14-Pin Plastic DIP
Si9100DN	3 W Regulator	10 to 70	Telecom	20-Pin PLCC
Si9102DJ	3 W Regulator	10 to 120	Telecom	14-Pin Plastic DIP
Si9102DN	3 W Regulator	10 to 120	Telecom	20-Pin PLCC
Si9105DJ	1 W Regulator	10 to 120	Telecom	14-Pin Plastic DIP
Si9105DN	1 W Regulator	10 to 120	Telecom	20-Pin PLCC
Si9110AK	35 W Controller	10 to 120	Military	14-Pin Ceramic DIP
Si9110DJ	35 W Controller	10 to 120	Telecom	14-Pin Plastic DIP
Si9110DY	35 W Controller	10 to 120	Telecom	14-Pin SOIC
Si9111DJ	35 W Controller	10 to 120	Telecom	14-Pin Plastic DIP
Si9111DY	35 W Controller	10 to 120	Telecom	14-Pin SOIC
Si9112DJ	35 W Controller	9 to 80	Comp./Indus.	14-Pin Plastic DIP
Si9112DY	35 W Controller	9 to 80	Comp./Indus.	14-Pin SOIC
Si9120DJ	50 W Controller	50 to 450	Comp./Indus.	16-Pin Plastic DIP

* Regulators have on-board MOSFETs. Controllers drive external MOSFETs.

Siliconix

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Power ICs

Printers, Plotters, and Copiers

The Si9976DY driver and Siliconix's 50-V LITTLE FOOT dual MOSFETs provide all of the functions necessary to control 20- to 40-V motors in applications such as printers, plotters, and copiers. This is the industry's first surface-mount motor control solution with capability up to 5 A.

AC Motor Control and UPS

Our unique Si9910 "adaptive" power MOSFET driver for motor drive circuits adapts to the power MOSFET's operating conditions, providing protection for the MOSFETs and improving system performance and efficiency while reducing costs. Used in tandem, the Si9910 adaptive MOSFET driver and our 500-V fast-t_{rr} power MOSFETs provide optimal power handling capability, circuit protection, and logic interface for high-voltage motor control applications and uninterruptible power supplies (UPS). End products for motor control applications include washing machines, air conditioners, pumps, compressors, fans, and blowers.

Automotive and Factory Automation Multiplexing

The Si9200 CAN Bus driver, for use in the CAN automotive multiplexing system, provides the only available integrated interface between the physical bus and the bus controller.

CAN Bus Driver

Part No.	Functional Description*	Supply Voltage (V)	Output Current (mA)	Application	Package Type
Si9200AY	Transciever IC that Interfaces Between a BUS Controller and the Physical BUS	4.5 to 5.5	35	Automobiles and Industrial Controllers	8-Pin SOIC

Analog Switches

Functional Configuration	Part No.	Max. $r_{DS(ON)}$ (Ω)	Max. $I_{S(OFF)}$ (nA)	Max. Switching Time t_{ON} (nS)	Max. Supply Range (V)	Package Type
1-Channel SPST	DG417	35	0.25	175	44	J, K, Y
	DG418	35	0.25	175	44	J, K, Y
2-Channel SPST	DG180	10	10.00	300	36	A, P
	DG181	30	1.00	150	36	A, P
	DG182	75	1.00	250	36	A, P
	DG200A	70	2.00	1000	44	A, J, K
	DG300A	50	1.00	300	44	A, J, K
	DG304A	50	1.00	250	44	J, K
	DG381A	50	1.00	300	44	J
	DG401	35	0.25	150	44	J, K, Z
	DG421	35	0.25	250	44	J
4-Channel SPST	DG201A	175	1.00	600	44	J, K, Y, Z
	DG202	175	1.00	600	44	K, J
	DG211	175	5.00	1000	44	J, Y
	DG212	175	5.00	1000	44	J, Y
	DG221	100	1.00	550	44	J, K, Y
	DG271	50	1.00	60	44	J, K, Y, Z
	DG308A	100	1.00	200	44	J, K, Y
	DG309	100	1.00	200	44	J, Y
	DG411	35	0.25	175	44	J, K, Y, Z
	DG412	35	0.25	175	44	J, K, Y, Z
	DG413	35	0.25	175	44	J, K, Y, Z
	DG441	85	0.50	250	44	J, K, Y, Z
	DG442	85	0.50	250	44	J, K, Y, Z
	DG444	85	0.50	250	44	J, Y
	DG445	85	0.50	250	44	J, Y
	DG540	60	10.00	90	21	J, N, P
	DG541	60	10.00	90	21	J, P, Y
	DG601	35	4.00	45	22	J, K, Y
	DG611	60	0.25	35	22	J, K, Y
	DG612	60	0.25	35	22	J, K, Y
	DG613	60	0.25	35	22	J, K, Y
	DG641	15	20.00	70	21	J, Y
1-Channel SPDT	DG186	50	1.00	1000	44	A, P
	DG187	10	10.00	1000	36	A, P
	DG188	100	1.00	1000	36	A, P
	DG301A	25	0.25	175	44	A, J, K, Z
	DG305A	30	0.50	200	44	A
	DG387A	30	1.00	800	36	A, J, K
	DG419	25	0.50	125	44	J, K, Y
	DG642	8	40.0	100	21	J, Y

A = Metal Can (TO-99) J = Plastic DIP K = Ceramic DIP M = CLCC
N = PLCC P = Side Braze R = Ceramic Y = SO Z = LCC

1-800-554-5565 ext. 1667

Analog ICs

Siliconix has more than twenty years experience in the design and manufacture of analog switch and multiplexer ICs. Beginning with the first monolithic analog switch released in 1968, we have continued to develop new switch products using PMOS, bipolar/JFET, CMOS, and DMOS technologies. These products are designed to handle a wide range of applications—from low-level dc signals, to audio signals, to products that operate in the hundreds of megahertz range, such as those needed for video and LAN applications.

Silicon-Gate CMOS Technology Enhances Analog Switch Performance

At Siliconix, we have developed a high-voltage silicon-gate CMOS process that allows us to manufacture analog switches with lower analog channel leakages, higher accuracy, and faster operation than any other industry-standard products. This DG400 family of products includes functional and pin-for-pin replacements for industry-standard part numbers that are inherently more reliable than their metal-gate predecessors. Electrostatic protection (4000 V minimum) has been incorporated into these designs to eliminate the primary cause of customer manufacturing and field failures. These new analog switches are also designed to operate at many different voltages, thus adapting to specific system requirements. New switch functions have been designed with this silicon-gate technology, such as the DG485

Analog Switches

Functional Configuration	Part No.	Max. $r_{DS(ON)}$ (Ω)	Max. $I_{S(OFF)}$ (nA)	Max. Switching Time t_{ON} (nS)	Max. Supply Range (V)	Package Type
2-Channel SPDT	DG189	10	10.00	300	36	P
	DG190	30	1.00	150	36	P
	DG191	75	1.00	250	36	P
	DG243	50	1.00	1000	44	J
	DG303A	50	1.00	300	44	J, K, Z
	DG307A	50	1.00	250	44	J, K, Z
	DG390A	50	1.00	300	44	J, K
	DG403	35	0.25	150	44	J, K, Y, Z
	DG423	35	0.25	250	44	J
	DG5043	50	1.00	1000	44	J
	DG5143	30	0.50	200	44	J
	DG542	60	10.00	90	18	J, P, Y
1-Channel DPST	DG183	10	10.00	300	36	P
	DG185	75	1.00	250	36	P
	DG302A	50	1.00	300	44	J, K
	DG306A	50	1.00	250	44	J, K
	DG384A	50	1.00	300	44	J, K
2-Channel DPST	DG184	30	1.00	150	36	P
	DG405	35	0.25	150	44	J, K, Y, Z
	DG425	35	0.25	250	44	J

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Buffers/Amplifiers

Functional Configuration	Part No.	Min. Supply Voltage (V)	Max. Supply Voltage (V)	Max. Input Offset Voltage (mV)	TC Input Offset (μV/° C)	Package Type
450-MHz Video Buffer	Si581	±3.0	±7	8		J, Y
180-MHz Video Amplifier	Si582	±3.0	±7	5.5	40	J, Y
200-MHz Quad Video Buffer	Si584	±3.0	±7	5		J, Y

Voltage Converters

Part No.	Max. Input Current (mA)	Min. Supply Voltage (V)	Max. Supply Voltage (V)	Min. Output Voltage (V)	Max. Output Voltage (V)	Package Type
Si7660	0.5	1.5	10	-10	20.0	J, Y
Si7661	2.0	60.0	20	-20.0	40.0	J

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Analog ICs

analog switch array which allows any-combination-of-eight-channel switching and multiplexing.

D/CMOS Technology Yields High-Quality Video Switches

Combining the performance features of its lateral DMOS technology and the advantages of CMOS, Siliconix has introduced a line of high-performance wideband analog switches and multiplexers. Designed to replace electromechanical and discrete solutions, these ICs boast bandwidths to 300 MHz at speeds to 300 ns. Crosstalk and off-isolation specifications are 20 to 30 dB better than previously available state-of-the-art ICs. One of these wideband multiplexers (the DG536) replaces over fifty discrete switches plus their drivers and logic interface. This enables substantial savings in board space, power dissipation, and cost, with the expected reduction in system complexity and improved quality and reliability. Further integration of these devices (e.g., the DG884 crosspoint array) reduces space and cost requirements even further, making high-end applications feasible that were previously too bulky, expensive, and complicated to implement. These ICs have been designed into video text distribution systems, graphics processor boards, military FLIR (forward-looking infrared radar) systems, studio quality video and television equipment, and high-quality audio systems.

Siliconix, Inc.
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Santa Clara, CA 95054-1516, U.S.A.

Analog Multiplexers

Part No.	Functional Configuration	Input Latches	Max $r_{DS(ON)}$ (Ω)	$I_{D(OFF)}$ (nA)	Analog Range (V)	Transition Time (µs)	Package Type
DG408	8-Ch Mux + Enable	No	100	1	±15	0.2	J, K, Y
DG458	8-Ch Fault Protected MUX	No	500	1	±9.5	0.5	J, K
DG485	8-Ch Serial Input Switch Array	Yes	85	1	±15	0.2	J
DG501	8-Ch Mux + Enable	No	150	8	±5	1.5	J, P
DG503	8-Ch Mux + Enable	No	150	8	±10	1.5	J, P
DG508A	8-Ch Mux + Enable	No	400	10	±15	1.0	J, K, Y, Z
DG528	8-Ch Mux + Enable	Yes	400	10	±15	1.0	J, K
DG538	8-Ch. Single/ 4-Ch Diff Mux	Yes	90	10	-5 to +10	0.2	J, N, P
DG506A	16-Ch Mux + Enable	No	400	10	±15	1.0	J, K, R
DG535	16-Ch Mux + Enable	Yes	90	10	0 to 10	0.3	J, P, Z
DG536	16-Ch Mux + Enable	Yes	90	10	0 to 10	0.3	N
DG409	4-Ch Diff Mux	No	100	1	±15	0.2	J, K, Y
DG459	4-Ch Diff Mux	No	500	1	±9.5	0.5	J, K
DG509A	4-Ch Diff Mux	No	400	10	±15	1.0	J, K, Y
DG529	4-Ch Diff Mux	Yes	400	10	±15	1.0	J, K
DG534	4-Ch Single/ 2-Ch Diff Mux	Yes	90	10	-5 to +10	0.3	J, N, P
DG538	8-Ch Single/ 4-Ch Diff Mux	Yes	90	10	-5 to +10	0.3	J, N, P
DG507A	8-Ch Dual Mux + Enable	No	400	5	±15	1.0	J, K, R
Specials							
DG884	8 x 4 Cross-point Array	Yes	90	20	-5 to +8	0.3	N, M
DG894	RGB Switch	Yes	100	10	±2	0.2	J

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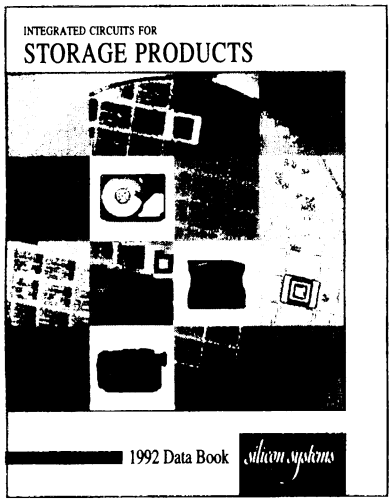
Serving World-Wide Markets with Mixed-Signal ICs – "MSICs™"

The Company

Silicon Systems was founded on its strength of design expertise. As it grew to add manufacturing capability, its successes were many in an industry known for its cyclic nature. Now, as one of the newest TDK Group Company members, Silicon Systems has added to its strengths the financial stability and resources associated with being part of a large global corporation.

For twenty years we at Silicon Systems have developed the highest possible level of technical expertise by designing and manufacturing application-specific, mixed-signal integrated circuits (MSICs™) featuring analog and digital functions on the same chip. While products primarily target three niche markets – disk/tape storage, communications and automotive products – the company is currently expanding into new markets, including consumer electronics.



A full-line catalog of
Disk/Tape Storage IC products

The Disk/Tape Storage Products Market

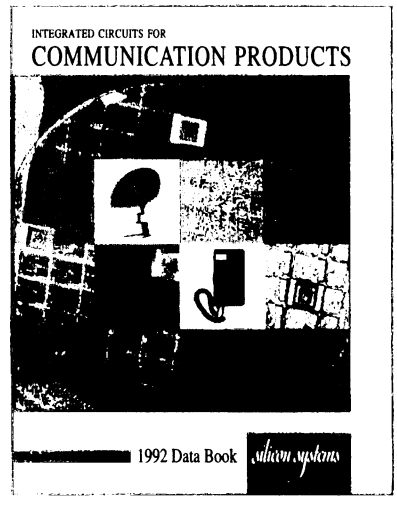
Nowhere has our success been more apparent than in the disk drive sector. Simply put, Silicon Systems dominates the hard disk drive IC business.

Starting in 1972, Silicon Systems established a reputation for excellence in mixed-signal design (both standard and custom) in read/write electronics. Today we are committed to the complete integration of disk drive electronics, from read/write ICs to pulse detection, data recovery, head positioning, motor speed control and programmable filters as well as a wide range of bus interface and controller ICs.

The Communications Market

Our modem ICs are truly systems-level products, combining front-end analog functions with Silicon Systems-developed firmware, a preprogrammed digital signal processor and microcontroller. Systems-level solutions like this provide the customer with a turn-key design solution and have established the company as the "standard setter" in the 1200 and 2400 bit/s modem arena.

Other communications products within this niche include digital transmission ICs such as DS-1 and DS-3 transceivers and local area network (LAN) devices. Our family of universal asynchronous receiver/transmitter (UART) ICs led to the development of a unique virtual UART technology. The resultant serial packet controller IC opened up multi-tasking computing environments to virtually any communications protocol.



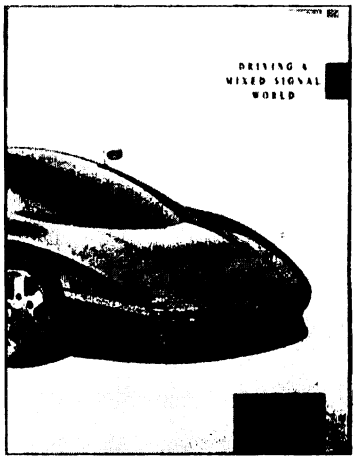
A full-line catalog of
Communication IC products

Silicon Systems Inc.

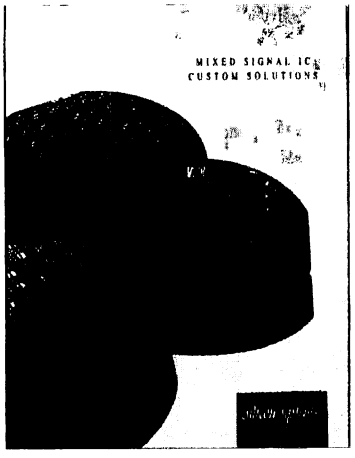
The Automotive Market

Silicon Systems can develop mixed-signal ICs (MSICs™) for virtually every system within the automobile, everything from engine management and direct ignition systems (DIS) to air bag control and emission control systems. Key to achieving such breakthrough performance are MSICs™ that let the automobile's digital microprocessor interface with, assess and respond to real world analog signals. Environmental and performance variables such as temperature, pressure, position, velocity, acceleration and mechanical stress are all sensed.

Silicon Systems is equipped to effectively provide the interface solution and give automotive design engineers an unmatched level of mixed-signal integrated circuit leadership and design innovation in their products.



A 12-page color brochure describing Automotive capabilities



A 12-page color brochure describing Custom capabilities

The Custom Market

For nearly 20 years Silicon Systems has provided custom solutions to customer design problems. Today, nearly half of the company's products are custom. Our designers are particularly adept at identifying key issues such as power, cost and performance trade-offs. They can then gear their efforts to providing the right mix of analog and digital circuitry and process technology to provide a total systems solution which will meet the customer's cost and performance objectives.

One important reason for this success is that each of our five worldwide design centers employs PEGASYS, an internal design automation system developed from carefully selected vendor tools and our own proprietary software. By integrating such powerful third-party tools and custom software, we're better able to design and analyze mixed-signal integrated circuits in all CMOS, Bipolar and BiCMOS technologies. It's an approach that has given us the edge in mixed-signal design and helped put Silicon Systems' customers in a favorable position in the marketplace.

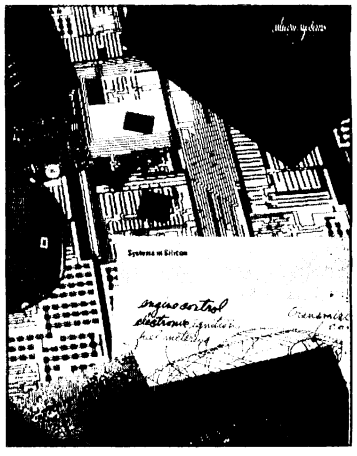
Quality Throughout

Whether your needs are for Silicon Systems' custom solutions or a standard product offering, we can offer truly innovative design and performance.

To maintain our position of leadership in the mixed-signal arena, we realize the need to combine innovation with consistently improving levels of quality. To do this, we must continually improve the quality of goods and service in every area of our operation, from administration and manufacturing procedures, to our approach to design.

For Silicon Systems the only true definition of quality is customer satisfaction. Quality improvement is a major element of the company's aggressive plans for future growth. A focused effort on continual improvement includes a master quality plan with specific, incremental quantitative goals. The most important element of Silicon Systems' goals for improvement, however, begins and ends with the customer.

For literature, contact Silicon Systems, your local sales representative, or call our toll free number **1-800-624-8999 ext. 151**.



A 12-page color Corporate Capabilities brochure

Silicon Systems, Inc. • 14351 Myford Road • Tustin, CA 92680 • (714) 731-7110, FAX (714) 669-8814

Silicon Systems Regional Sales Offices: Central U.S. (708) 810-1151; Eastern U.S. (603) 898-1444; Southwest U.S. (714) 832-5310; Northwest U.S. (408) 453-7811; Europe (44) 81-443-7061 Far East (except Japan) (65) 744-7700; Japan (03) 32785049

Silicon Systems Inc.

SILICON SYSTEMS STORAGE PRODUCTS SELECTOR GUIDE

HDD READ/WRITE AMPLIFIERS									
SSI 32R117	3 Terminal	2, 4, 6	2.1	20	100	10 to 50	+5, +12	TTL	8.0 (0-pk)
SSI 32R117A	3 Terminal	2, 4, 6	1.7	20	100	10 to 50	+5, +12	TTL	8.0 (0-pk)
SSI 32R501	3 Terminal	4, 6, 8	1.5	23	100	10 to 50	+5, +12	TTL	7.5 (0-pk)
SSI 32R510A	3 Terminal	2, 4, 6	1.5	20	100	10 to 40	+5, +12	TTL	7.0 (0-pk)
SSI 32R511	3 Terminal	4, 6, 8	1.5	20	100	10 to 40	+5, +12	TTL	7.0 (0-pk)
SSI 32R516	3 Terminal	4, 6, 8	1.3	18	120	10 to 60	+5, +12	TTL	7.0 (0-pk)
SSI 32R5161	3 Terminal	10	1.3	18	150	10 to 60	+5, +12	TTL	7.0 (0-pk)
SSI 32R518	3 Terminal	4, 6, 8	1.3	18	150	10 to 60	+5, +12	TTL	7.0 (0-pk)
SSI 32R1200	3 Terminal	2, 4	1.2	17	200	15 to 50	+5	TTL	6.0 (0-pk)
SSI 32R1220	3 Terminal	2, 4	0.8	17	250	15 to 40	+5	TTL	6.0 (0-pk)
SSI 32R512	2 Terminal	8, 9	0.85	35	150	10 to 40	+5, +12	TTL	7.0 (pk-pk)
SSI 32R5121	2 Terminal	14	0.85	35	250	10 to 40	+5, +12	TTL	7.0 (pk-pk)
SSI 32R521	2 Terminal	6	0.9	65	150	20 to 70	+5, +12	TTL	3.4 (pk-pk)
SSI 32R5211	2 Terminal	6	0.9	65	250	20 to 70	+5, +12	TTL	3.4 (pk-pk)
SSI 32R522	2 Terminal	4, 6	1.0	32	100	6 to 35	+5, +12	TTL	3.4 (pk-pk)
SSI 32R524	2 Terminal	8	0.75	60	100	20 to 60	+5, +12	TTL	7.0 (pk-pk)
SSI 32R525	2 Terminal	4	0.8	35	150	25 to 40	+5, −5	Differential / Differential	3.8 (pk-pk)
SSI 32R526	2 Terminal	4	0.6	65	100	17 to 50	+5, −5	Differential	8.0 (pk-pk)
SSI 32R527	2 Terminal	8, 9	0.85	35	120	10 to 40	+5, +12	Differential	7.0 (pk-pk)
SSI 32R528	2 Terminal	8, 9	0.85	35	150	10 to 40	+5, +12	Differential	7.0 (pk-pk)
SSI 32R5281	2 Terminal	14	0.85	35	250	10 to 40	+5, +12	Differential	7.0 (pk-pk)
SSI 32R529	2 Terminal	8	0.8	35	125	17 to 50	+5, −5	Differential	8.0 (pk-pk)
SSI 32R2010	2 Terminal	10, 16	0.84	26	150	10 to 25	+5, +12	Differential	7.0 (pk-pk)
SSI 32R2011	2 Terminal	10, 16	.84	26	150	10 to 25	+5, +12	Differential	7.0 (pk-pk)
SSI 32R2015	2 Terminal	10, 16	0.84	26	150	10 to 25	+5, +12	TTL	7.0 (pk-pk)
SSI 32R2020	2 Terminal	2, 4, 10	0.8	20	300	5 to 35	+5	TTL	3.4 (pk-pk)
SSI 32R2030A	2 Terminal	2, 4	0.85	35	250	10 to 35	+5	TTL	3.4 (pk-pk)
SSI 32R4610A	2 Terminal	2, 4, 8	0.85	35	200	10 to 35	+5	TTL	3.4 (pk-pk)

HDD PULSE DETECTION		
SSI 32P541	Read Data Processor	AGC, Amplitude & Time Pulse Qualification, RLL Compatible
SSI 32P541A	Read Data Processor	32P541 pin compatible w/ Enhanced Write to Read Recovery and Voltage Fault Detection
SSI 32P541B	Read Data Processor	32P541 pin compatible, 32P541A w/ Increased Data Rate to 24 Mbit/s
SSI 32P544	Pulse Detector	32P541-type Pulse Detector w/ Embedded Servo Electronics
SSI 32P547	Pulse Detector	32P544-type Pulse Detector w/ Filter Multiplexer, Pulse Slimming Support
SSI 32P549	Read Data Processor	32P541 pin compatible, Low Power, +5V only, Enhanced Write to Read Recovery
SSI 32P5491	Read Data Processor	32P549 pin compatible, 5 mW Idle Mode power, Pd = 170 mW
SSI 32P3000	Pulse Detector / Programmable Filter	48 Mb/s Pulse Detector with 9-27 MHz Bessel filter, +5V only
SSI 32P3010	Pulse Detector / Programmable Filter	48 Mb/s Pulse Detector with 9-27 MHz Bessel filter, 4-burst servo capture
SSI 32P3030	Pulse Detector w/Servo Demodulator	Pulse Detector w/2-burst servo demodulator, +5V only
SSI 32P3040	Pulse Detector / Programmable Filter	24-32 Mbit/s Pulse Detector w/2.5-13 MHz Bessel Filter, +5V only
HDD READ CHANNEL COMBINATION DEVICES		
SSI 32D4420	Programmable Filter / Time Base Generator	7-pole Equiripple Filter, Control DACs, 72 MHz Frequency Synthesizer
SSI 32P548	Pulse Detector / Data Synchronizer	32P544-type w/ 2, 7 Synchronizer, Low Power, +5V only, <700 mW
SSI 32P5481	Pulse Detector / Data Synchronizer	Low power 32P548-type device (375 mW)
SSI 32P5482	Pulse Detector / Data Synchronizer	Low power 32P548-type device (375 mW), no Write Precompensation
SSI 32P4622	Pulse Detector / Data Separator	32P541-type + 32D537-type, no Filter Section, 52-pin QFP, 900 mW
SSI 32P4720	Pulse Detector / Data Separator	32P548-type + 1, 7 ENDEC, Window Shift, Power-down, 52-pin QFP, 650 mW
SSI 32P4721	Pulse Detector / Data Separator	32P4720 @12 to 24 Mbit/s, <700 mW

When contacting suppliers, say you saw it in IC MASTER

HDD ACTIVE FILTERS		
SSI 32F8000	Programmable Channel Filter	7-Pole Equiripple Active Filter, Programmable Cutoff Frequency / Pulse Slimming, 9 - 27 MHz
SSI 32F8030	Programmable Channel Filter	7-Pole Equiripple Active Filter, Programmable Cutoff Frequency / Pulse Slimming, 250 kHz - 2.5 MHz
SSI 32F8011	Programmable Channel Filter	7-Pole Bessel Active Filter, Programmable Cutoff Frequency / Pulse Slimming, 5 - 13 MHz
SSI 32F8020	Programmable Channel Filter	7-Pole Equiripple Active Filter, Programmable Cutoff Frequency / Pulse Slimming, 1.5 - 8 MHz
SSI 32F8120	Digitally Programmable Filter	32F8020 functions + DAC's/Serial port
SSI 32F8130/31	Digitally Programmable Filter	32F8030 functions + DAC's/Serial port, 8131 150 kHz <f_c <1.5 MHz
HDD DATA RECOVERY		
SSI 32D4010	Data Separator	Data Synchronizer / 1, 7 RLL ENDEC 12 to 24 Mbit/s / Write Precompensation / Window Shift / Low Power
SSI 32D4020	Data Separator	Data Synchronizer / 1, 7 or 2, 7 ENDEC, Integrated Loop Filter, 175 mW CMOS
SSI 32D5321	Data Separator	Data Synchronizer / 2, 7 RLL ENDEC 7.5 to 10 Mbit/s
SSI 32D5322A	Data Separator	Data Synchronizer / 2, 7 RLL ENDEC 7.5 to 15 Mbit/s
SSI 32D534A	Data Separator	Data Synchronizer / MFM ENDEC / Write Precompensation
SSI 32D5351A	Data Separator	Data Synchronizer / 2, 7 RLL ENDEC / Write Precompensation 8 to 18 Mbit/s
SSI 32D5362A	Data Separator	Data Synchronizer / 1, 7 RLL ENDEC / Write Precompensation 10 to 20 Mbit/s
SSI 32D5371/2	Data Separator	Data Synchronizer / 1, 7 RLL ENDEC / Write Precompensation 12 to 24 Mbit/s
SSI 32D5373/4	Data Separator	Data Synchronizer / 1, 7 RLL ENDEC / Write Precompensation 15 to 32 Mbit/s
SSI 32D539	Data Separator	Data Synchronizer / 1.7 RLL ENDEC / 8-bit parallel NRZ 24 to 48 Mbit/s
SSI 32D5391	Data Separator	Data Synchronizer / 1, 7 RLL ENDEC / Serial NRZ 24 to 40 Mbit/s
SSI 32D5392	Data Separator	Data Synchronizer / 1, 7 RLL ENDEC / Dual-bit NRZ 24 to 48 Mbit/s
SSI 32D4660/1/2	Time Base Generator	Up to 100 MHz Reference Frequency PLC for Constant Density Recording
HDD HEAD POSITIONING		
SSI 32H101	Preamplifier -Ferrite head	AV = 93, BW = 10 MHz, e_n = 7.0 nV/√Hz
SSI 32H116A	Preamplifier -Thin Film head	AV = 250, BW = 20 MHz, e_n = 0.94 nV/√Hz
SSI 32H523R	Servo Read/Write	Single-channel Thin Film Read/Write Device
SSI 32H566R	Servo Read/Write	Single-channel Ferrite Read/Write Device
SSI 32H569	Servo Motor Driver	Head Parking, Spindle Motor Braking
SSI 32H4631	Combo Servo & Motor Speed Control	Embedded & Hybrid Servo, Hall Sensor-less Motor Speed Control, +5V only
SSI 32H6110	Preamplifier -Thin Film head	AV = 250 or 300, BW = 20 MHz, e_n = 0.85 nV/√Hz
SSI 32H6210	Servo Demodulator	Di-bit Quadrature Servo Pattern; PLL Synchronization AGC Adjustment
SSI 32H6220	Servo Controller	Track & Seek Mode Operation; Microprocessor Interface
SSI 32H6230	Servo Motor Driver	Head Parking, Spindle Motor Braking, Voltage Clamp
SSI 32H6240	Servo Motor Driver	Predriver for Bipolar H-bridge
SSI 32H6510	Servo 5V Driver	Low Voltage Retract, 1Ω drivers
SSI 32H6520	Servo Acquisition and D/A	10-bit A/D D/A circuits, DSP interface
HDD SPINDLE MOTOR CONTROL		
SSI 32M593A	3-Phase Motor Speed Control	±0.037% Speed Accuracy; Bipolar Operation, 5 1/4" Drives
SSI 32M594	3-Phase Motor Speed Control	±0.037% Speed Accuracy; Bipolar Operation, 3 1/2" & 5 1/4" Drives
SSI 32M595	3-Phase Sensor-less MSC	Hall Sensor-less; Motor Speed Control
SSI 32M7010	Motor Speed Control 5V Driver	Hall Sensor-less; Commutator Digital Speed Control, 5V 1Ω Driver
SSI 32M7011	Motor Speed Control 5V Commutator	Hall Sensor-less; Commutator, 5V 1Ω Driver
HDD CONTROLLER/INTERFACE		
SSI 32C260	PC AT/XT Combo Controller	15 Mbit/s Combo Buffer Manager/Disk Controller/AT/XT
SSI 32C261	PC AT/XT Combo Controller	(RLL 2, 7 ENDEC: SH-260 Compatible) / AT/XT Interface
SSI 32C4650	PC AT/XT Combo Controller	26 Mbit/s Disk Controller/AT/XT; SH-260 Compatible
SSI 32C4651	PC AT/XT Combo Controller	26 Mbit/s Disk Controller/AT/XT; SH-265 compatible
SSI 32C9000	High Perf. PC AT Combo Controller	32 Mbit/s; High Performance AT Disk Controller
SSI 32C9010	High Perf. SCSI Combo Controller	32 Mbit/s; SCSI-2 compatible; Fast SCSI; single ended
SSI 32C9020	High Perf. SCSI Combo Controller	48 Mbit/s; SCSI-2 compatible; Fast SCSI; single ended
FLOPPY DISK DRIVES		
SSI 34D441	Data Separator	High Performance Analog Data Separator, NEC 765 Compatible
SSI34P553	Pulse Detector / Data Synchronizer	0.6 - 1.6 Mbit/s data rate, MFM or 2, 7 RLL code
SSI 34R575	Read/Write	2, 4 Channel Read/Write Circuit
SSI 34B580	Support Logic	Port Expander, Includes SA400 Interface Drivers/Receivers

Silicon Systems Headquarters: 14351 Myford Road, Tustin, CA 92680 (714) 731-7110, FAX (714) 669-8814 **Regional Sales Offices:** Central U.S. (708) 810-1151; Eastern U.S. (603) 898-1444; Southwest U.S. (714) 832-5310; Northwest U.S. (408) 980-9771; Europe (44) 81-443-7061; Far East (except Japan) (65) 744-7700; Japan (03) 32785049

SILICON SYSTEMS COMMUNICATION PRODUCTS SELECTOR GUIDE

K-SERIES SINGLE CHIP MODEM FAMILY									
SSI 73K212	✗						Bell 212A/103	+12V	28 DIP, 28 PLCC
SSI 73K212S	✗						73K212 with serial interface only	+12V	22 DIP
SSI 73K212L	✗						Low Power 73K212	+5V	28 DIP, 28 PLCC
SSI 73K212SL	✗						73K212L with serial interface only	+5V	22 DIP
SSI 73K221			✗		✗		CCITT V.22/V.21	+12V	22, 28 DIP, 28 PLCC
SSI 73K221S			✗		✗		73K221 with serial interface only	+12V	22 DIP
SSI 73K221L			✗		✗		Low Power 73K221	+5V	22, 28 DIP, 28 PLCC
SSI 73K221SL			✗		✗		73K221L with serial interface only	+5V	22 DIP
SSI 73K222	✗		✗		✗		Bell 212A/103, CCITT V.22/V.21	+12V	22, 28 DIP, 28 PLC
SSI 73K222S	✗		✗		✗		73K222 with serial interface only	+12V	22 DIP
SSI 73K222L	✗		✗		✗		Low Power 73K222	+5V	22, 28 DIP, 28 PLCC
SSI 73K222SL	✗		✗		✗		73K222L with serial interface only	+5V	22 DIP
SSI 73K222U	✗		✗		✗		73K222L with 16C450 UART	+5V	40 DIP
SSI 73K224L	✗		✗		✗	✗	Bell 212A/103, CCITT V.22bis/V.22/V.21	+5V	28 DIP, 32, 44 PLCC
SSI 73K302L	✗	✗					Bell 212A/202/103	+5V	28 DIP, 28 PLCC
SSI 73K302SL	✗	✗					Bell 212A/202/103; serial interface only	+5V	22 DIP
SSI 73K312L	B103	✗	✗	✗			BELL 202/103; CCITT V.21/V.23	+5V	28 DIP, 28 PLCC
SSI 73K312SL	B103	✗	✗	✗			73K312L with serial interface only	+5V	22 DIP
SSI 73K321L			✗	✗			CCITT V.23/V.21	+5V	28 DIP, 28 PLCC
SSI 73K321SL			✗	✗			73K321L with serial interface only	+5V	22 DIP
SSI 73K322L			✗	✗	✗		CCITT V.23/V.22/V.21	+5V	28 DIP, 28 PLCC
SSI 73K322SL			✗	✗	✗		73K322L with serial interface only	+5V	22 DIP
SSI 73K324L			✗	✗	✗	✗	CCITT V.22bis/V.22/V.23/V.21	+5V	28 DIP, 32 PLCC
MODEM PROTOCOL PRODUCTS/ DEVICE SETS									
SSI 73D2180	✗		✗		✗		Modem Device Set w/ "AT" (73K222U based design)	+5V	Various DIP & PLCC
SSI 73D2240	✗		✗		✗	✗	Modem Device Set w/ "AT" (73K224L based design)	+5V	Various DIP & PLCC
SSI 73D2404	✗		✗		✗	✗	Modem Device Set w/ "AT" (73K214 based design)	±5V	Various DIP & PLCC
SSI 73D2407	✗		✗		✗	✗	Modem Device Set w/ "AT" MNP 4&5 (73K214 based design)	±5V	Various DIP & PLCC
SSI 73D2417	✗		✗		✗	✗	Modem Device Set w/ "AT" MNP 4&5, + transmit FAX	±5V	Various DIP & PLCC
SSI 73D2421	✗		✗		✗	✗	Modem Device Set w/ "AT" MNP 4&5,V.42,V.42bis, Hayes V-series	+5V	Various DIP & PLCC
SSI 73D2247/A	✗		✗		✗	✗	Modem Device Set w/ "AT" (73K224L based design)	+5V	Various DIP & PLCC
SSI 73D2247/5	✗		✗		✗	✗	Modem Device Set w/ "AT" MNP 4&5	+5V	Various DIP & PLCC
SSI 73D2247/V	✗		✗		✗	✗	Modem Device Set w/ "AT" MNP 4&5, V.42	+5V	Various DIP & PLCC
SSI 73D2247/Z	✗		✗		✗	✗	Modem Device Set w/ "AT" MNP 4&5, V.42, V.42bis	+5V	Various DIP & PLCC

Notes: All SSI 73D2247 Device Sets come with a Configurable Command Interpreter.

All SSI 73D2247 Device Sets can be ordered with or upgraded to 9600 bit/s send/receive FAX.

The SSI 73K324L can be substituted for the 73K224L. The device set number will change accordingly (e.g., from 73D2247/A to 73D3247/A).

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SPECIAL MODEM PRODUCTS				
SSI 73M214	2400 bit/s Modem Filter	V.22bis/V.22/V.21, Bell 212/103 modes	±5V	28 DIP, PLCC
SSI 73M223	1200 bit/s Modem IC	Compact HDX V.23 modem	+5V	16 DIP
SSI 73M376	Integrated Line Interface	The active components of a DAA in a chip used on 73M9001	+5V	28 PLCC
SSI 73M9001	V.32bis DAA Microcodule	Full DAA for V.32bis applications	+5V	Module
ANALOG SIGNALLING AND SWITCHING PRODUCTS				
SSI 75T201	Integrated DTMF Receiver	Binary coded 2-of-8 output	+12V	22 DIP
SSI 75T202	Integrated DTMF Receiver	Low power, binary output	+5V	18 DIP
SSI 75T203	Integrated DTMF Receiver	Early detect, binary output	+5V	18 DIP
SSI 75T204	Integrated DTMF Receiver	Low power, binary output	+5V	14 DIP, 16 SO
SSI 75T2089	Integrated DTMF Transceiver	Generator & receiver, µP interface	+5V	22 DIP
SSI 75T2090	Integrated DTMF Transceiver	Like 75T2089 w/ call progress detect	+5V	22 DIP
SSI 75T2091	Integrated DTMF Transceiver	Like 75T2090 w/ early detect	+5V	28 DIP, PLCC
SSI 75T980	Imprecise Call Progress Detector	Energy detect in 305-640 Hz band, Teltone	+5V	8 DIP
SSI 75T981	Precise Call Progress Detector	Det. 350, 400, 440, 480 Hz, Teltone 2nd source	+5V	22 DIP
SSI 75T982	Precise Call Progress Detector	Det. 350, 440, 480, 620 Hz, Teltone 2nd source	+5V	22 DIP
SSI 78A093A/B	12x8x1 Crosspoint Switch	Low ON resistance, two versions	+5, +12V	40 DIP, 44 PLCC
SSI 78A207	Integrated MF Receiver	Detects central office toll signals	+5V	20 DIP
PCM PRODUCTS				
SSI 78P233	DS-1 Line Interface	T1 clock & data recovery, transmit equalization	+5V	24 DIP, SDIP, SO
SSI 78P234	2048 kBit/s PCM Interface	Receive clock & data recovery, transmit drivers	+5V	20 DIP, SO
SSI 78P236	DS-3 Line Interface	T3 clock & data recovery, transmit equalization	+5V	28 DIP
SSI 78P300	T1/E1 Short Haul Transceiver	Receive jitter attenuation	+5V	28 DIP, PLCC
SSI 78P2361	STS-1 Line Interface	STS-1 clock & data recovery, transmit equalization	+5V	28 DIP
SSI 78P2362	CEPT E-3 Line Interface	E3 clock & data recovery, transmit equalization	+5V	28 DIP
LAN PRODUCTS				
SSI 78Q8330	802.3 Coax Transceiver	10Base-2/10Base-5 applications	+9V	20 DIP, PLCC
SSI 78Q902	10BaseT MAU Transceiver	Direct interface to twisted pair and AUI	+5V	28 DIP, PLCC
SSI 78Q903	10BaseT Hub Transceiver	Programmable squelch, detect/correct reverse polarity	+5V	24 DIP, 28 PLCC
BUS INTERFACE PRODUCTS				
SSI 73M450	16C450 pin compatible UART		+5V	40 DIP, 44 PLCC
SSI 73M450F	Fast version of SSI 73M450 UART	Fast Bus Timing Specs	+5V	40 DIP, 44 PLCC
SSI 73M1450	28-pin version of SSI 73M450	Full UART in 28-pin package	+5V	28 DIP, PLCC
SSI 73M2450	28-pin version of 73M450	Adds µPRST function	+5V	28 DIP, PLCC
SSI 73M550	16C550 pin compatible UART	Receive and Transmit FIFOs	+5V	40 DIP, 44 PLCC
SSI 73M1550	28-pin version of SSI 73M550	Full UART in 28-pin package	+5V	28 DIP, PLCC
SSI 73M2550	28-pin version of 73M550	Adds µPRST function	+5V	28 DIP, PLCC
SSI 73M650	Serial Packet Controller	Sync/Async for PC bus	+5V	40 DIP, 44 PLCC
SSI 73M1650	28-pin version of 73M650		+5V	28 DIP, PLCC

Silicon Systems Headquarters: 14351 Myford Road, Tustin, CA 92680 (714) 731-7110, FAX (714) 669-81 **Regional Sales Offices:** Central U.S. (708) 810-1151; Eastern U.S. (603) 898-1444; Southwest U.S. (714) 832-5310; Northwest U.S. (408) 980-9771; Europe (44) 81-443-7061; Far East (except Japan) (65) 744-7700; Japan (03) 32785049

2K x 8 Nonvolatile Static RAM
CMOS nvSRAM
High Performance

PRELIMINARY

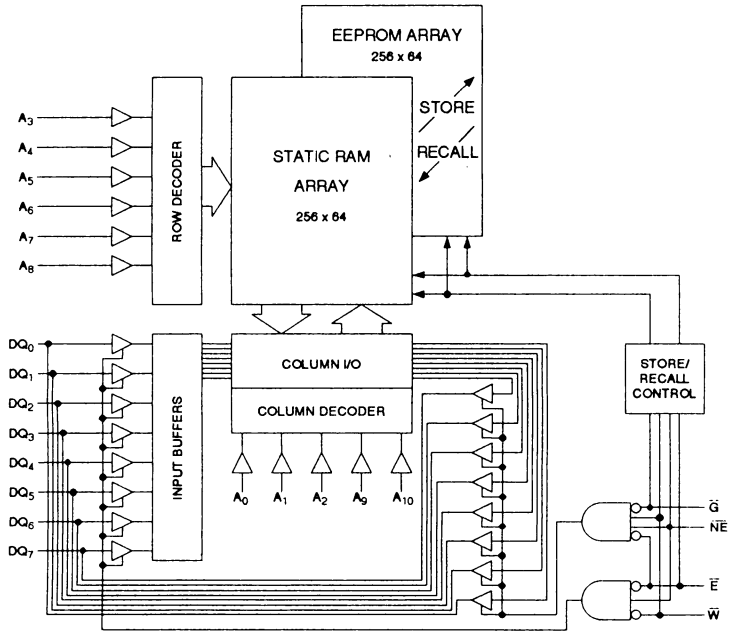
FEATURES

- **25, 30, 35 and 45ns Access (Commercial)**
- **30, 35, 45 and 55ns Access (Military)**
- **12, 15, 20 and 25ns Output Enable Access**
- **Unlimited Read and Write to SRAM**
- **Hardware & Software Store Initiation**
- **Automatic Store Timing**
- **10^4 or 10^5 Store cycles to EEPROM**
- **1 or 10 year data retention in EEPROM**
- **Automatic Recall on Power Up**
- **Hardware & Software Recall Initiation**
- **Unlimited Recall cycles from EEPROM**
- **Single 5V ±10% Operation**
- **Commercial, Industrial and Military Temp.**
- **Available in multiple standard packages**

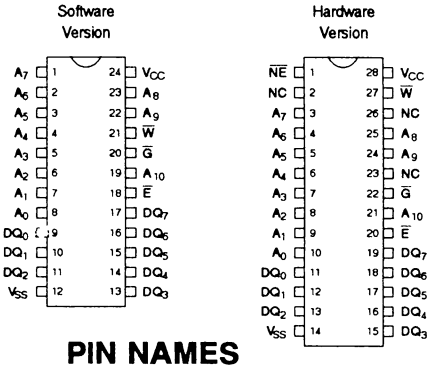
DESCRIPTION

The Simtek 2k x 8 nvSRAM is a fast static RAM (25, 30, 35, 45 and 55ns), with a nonvolatile electrically-erasable PROM (EEPROM) element incorporated in each static memory cell. The SRAM can be read and written an unlimited number of times, while independent nonvolatile data resides in EEPROM. Data may easily be transferred from the SRAM to the EEPROM (*STORE*), or from the EEPROM to the SRAM (*RECALL*) using the $\overline{NE}$ pin. Data transfers may also be initiated through software sequences. It combines the high performance and ease of use of a fast SRAM with nonvolatile data integrity.

LOGIC BLOCK DIAGRAM



PIN CONFIGURATIONS



PIN NAMES

$A_0 - A_{12}$	Address Inputs
$\overline{W}$	Write Enable
$DQ_0 - DQ_7$	Data In/Out
$\overline{E}$	Chip Enable
$\overline{G}$	Output Enable
$\overline{NE}$	Nonvolatile Enable
V_{CC}	Power (+5V)
V_{SS}	Ground

Simtek

1-800-637-1667

Simtek Corporation
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Colorado Springs, Colorado 80920 USA
(719) 531-9444 FAX (719) 531-9481

8K x 8 *AutoStore*™
CMOS nvSRAM
High Performance
Nonvolatile Static RAM

ADVANCE

FEATURES

- **30, 35, 45 and 55ns Access Times**
- **15 mA I_{CC} at 200ns Access Speed**
- **Automatic Store to EEPROM on Power Down**
- **HW or SW initiated Store to EEPROM**
- **Automatic Store Timing**
- **10^4 or 10^5 Store cycles to EEPROM**
- **10 year data retention in EEPROM**
- **Automatic Recall on Power Up**
- **SW initiated Recall from EEPROM**
- **Unlimited Recall cycles from EEPROM**
- **Unlimited Read and Write to SRAM**
- **Single 5V ±10% Operation**
- **Commercial, Industrial and Military Temp.**
- **Available in multiple standard packages**

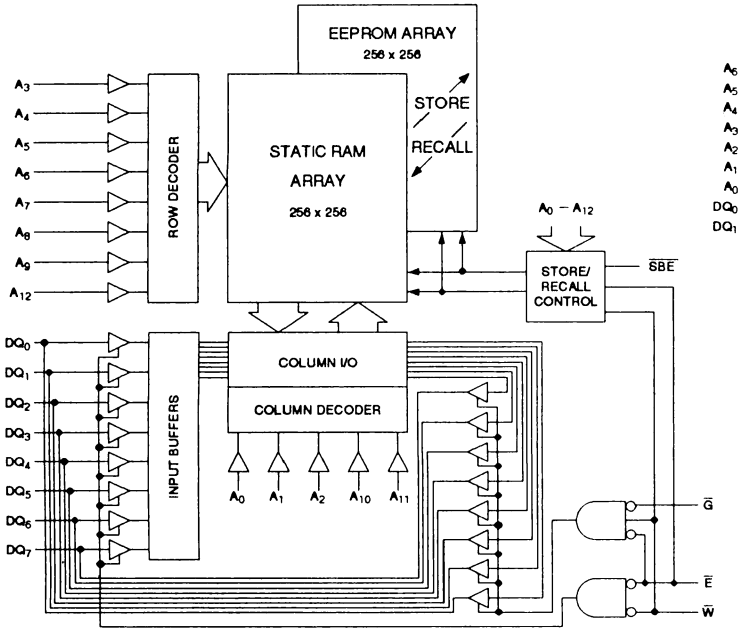
DESCRIPTION

The Simtek AutoStore is a fast static RAM (30, 35, 45 and 55ns), with a nonvolatile EEPROM element incorporated in each static memory cell. The SRAM can be read and written an unlimited number of times, while independent nonvolatile data resides in EEPROM. Data transfers from the SRAM to the EEPROM (the *STORE* operation) take place automatically upon power down using charge stored in an external 100 µF capacitor. Transfers from the EEPROM to the SRAM (the *RECALL* operation) take place automatically on power up. Software sequences may also be used to initiate both *STORE* and *RECALL* operations. A *STORE* can also be initiated via a single pin.

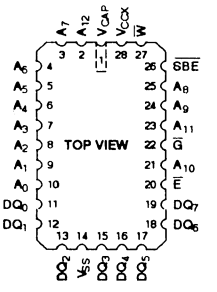
The AutoStore is available in the following packages: a 28-pin 300 mil ceramic and plastic DIP, a 28-pin SOIC and 28-pad LCC. Simtek is currently establishing a MIL-STD-883 compliant program.

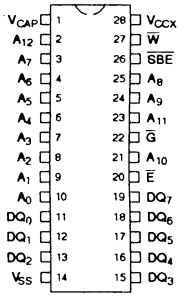
Simtek

LOGIC BLOCK DIAGRAM



PIN CONFIGURATIONS





PIN NAMES

$A_0 - A_{12}$	Address Inputs
$\overline{W}$	Write Enable
$DQ_0 - DQ_7$	Data In/Out
$\overline{E}$	Chip Enable
$\overline{G}$	Output Enable
V_{CCX}	Power (+5V)
V_{SS}	Ground
V_{CAP}	Capacitor
$\overline{SBE}$	Store Busy Enable

1-800-637-1667

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STK11C68

CMOS nvSRAM
High Performance
8K x 8 Nonvolatile Static RAM

FEATURES

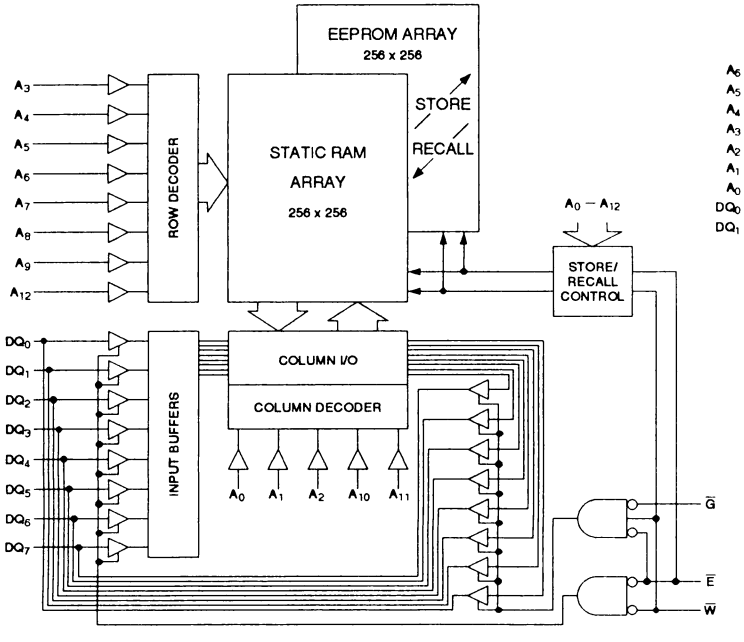
- **25, 30, 35 and 45ns Access (Commercial)**
- **30, 35, 45 and 55ns Access (Military)**
- **12, 15, 20 and 25ns Output Enable Access**
- **Unlimited Read and Write to SRAM**
- **Software initiated Store to EEPROM**
- **Automatic Store Timing**
- **10^4 or 10^5 Store cycles to EEPROM**
- **1 or 10 year data retention in EEPROM**
- **Automatic Recall on Power Up**
- **Software initiated Recall from EEPROM**
- **Unlimited Recall cycles from EEPROM**
- **Single 5V ±10% Operation**
- **Available in multiple standard packages**
- **Commercial, Industrial and Military Temp.**
- **Pin compatible with industry standard SRAMs**

DESCRIPTION

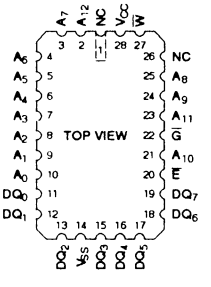
The Simtek STK11C68 is a fast static RAM (25, 30, 35, 45 and 55ns), with a nonvolatile electrically-erasable PROM (EEPROM) element incorporated in each static memory cell. The SRAM can be read and written an unlimited number of times, while independent nonvolatile data resides in EEPROM. Data transfers from the SRAM to the EEPROM (*STORE*) or from the EEPROM to the SRAM (*RECALL*) are initiated through software sequences. It combines the high performance and ease of use of a fast SRAM with nonvolatile data integrity.

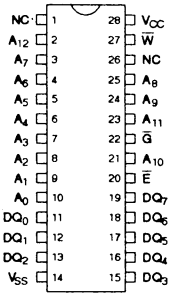
The STK11C68 is pin compatible with industry standard SRAMs and is available in a 28-pin 300 mil ceramic and plastic DIP, a 28-pin SOIC and 28-pad LCC packages. Simtek is currently establishing a MIL-STD-883 compliant program.

LOGIC BLOCK DIAGRAM



PIN CONFIGURATIONS





PIN NAMES

A_0 - A_{12}	Address Inputs
$\overline{W}$	Write Enable
DQ_0 - DQ_7	Data In/Out
$\overline{E}$	Chip Enable
$\overline{G}$	Output Enable
V_{CC}	Power (+5V)
V_{SS}	Ground

Simtek

1-800-637-1667

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STK10C68

CMOS nvSRAM
High Performance
8K x 8 Nonvolatile Static RAM

FEATURES

- **25, 30, 35 and 45ns Access (Commercial)**
- **30, 35, 45 and 55ns Access (Military)**
- **12, 15, 20 and 25ns Output Enable Access**
- **Unlimited Read and Write to SRAM**
- **Hardware Store Initiation**
- **Automatic Store Timing**
- **10^4 or 10^5 Store cycles to EEPROM**
- **1 or 10 year data retention in EEPROM**
- **Automatic Recall on Power Up**
- **Hardware Recall Initiation**
- **Unlimited Recall cycles from EEPROM**
- **Single 5V ±10% Operation**
- **Commercial, Industrial and Military Temp.**
- **Available in multiple standard packages**

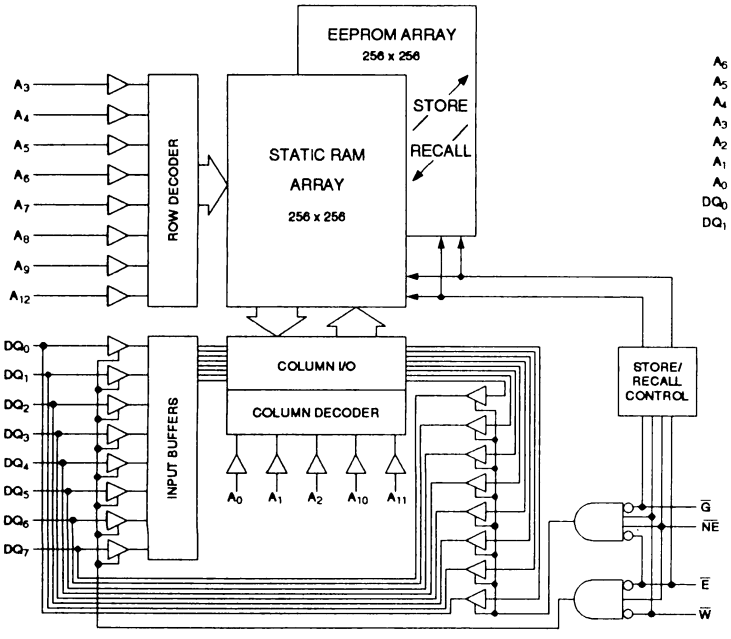
DESCRIPTION

The Simtek STK10C68 is a fast static RAM (25, 30, 35, 45 and 55ns), with a nonvolatile electrically-erasable PROM (EEPROM) element incorporated in each static memory cell. The SRAM can be read and written an unlimited number of times, while independent nonvolatile data resides in EEPROM. Data may easily be transferred from the SRAM to the EEPROM (*STORE*), or from the EEPROM to the SRAM (*RECALL*) using the $\overline{NE}$ pin. It combines the high performance and ease of use of a fast SRAM with nonvolatile data integrity.

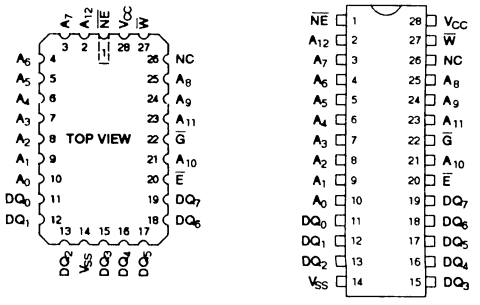
The STK10C68 features the industry standard pinout for nonvolatile RAMs in a 28-pin 300 mil ceramic and plastic DIP, a 28-pin SOIC and 28-pad LCC packages. Simtek is currently establishing a MIL-STD-883 compliant program.

Simtek

LOGIC BLOCK DIAGRAM



PIN CONFIGURATIONS



PIN NAMES

A_0 - A_{12}	Address Inputs
$\overline{W}$	Write Enable
DQ_0 - DQ_7	Data In/Out
$\overline{E}$	Chip Enable
$\overline{G}$	Output Enable
$\overline{NE}$	Nonvolatile Enable
V_{CC}	Power (+5V)
V_{SS}	Ground

1-800-637-1667

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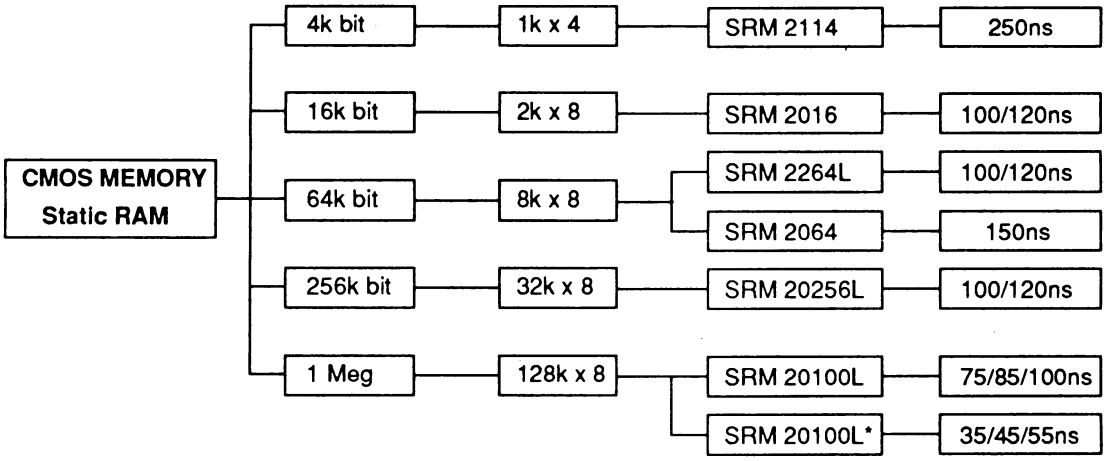
Memory Products

S-MOS Systems offers an assortment of CMOS memory products. Since 1987,S-MOS has moved quickly to expand its product offerings to OEM's. Our affiliate, Seiko Epson, has a world-class automated six inch 0.8µ and 1.0µ fabrication line. In addition to our new 128k x 8 SRAM, our popular SRM20256 / 32k x 8 SRAM is one of many products presently being produced on the six inch fab line.



* Under development

Static Rams

Our static RAMs are fabricated using advanced CMOS technology. S-MOS offers 1k x 4, 2k x 8, 8k x 8, 32k x 8 and 128k x 8 static RAMs with industry standard pinouts. In addition to our standard dual inline packages, we also offer space-saving, small outline packages, and thin small outline packages. Selected versions are also offered for industrial temperature ranges.

Organization	Part #	Access Time (ns Max)	Average Operating Current (mA Typ)	Standby Supply Current (µA Typ)	Package
1024 x 4	SRM2114	250	14	0.1	18[1]
2048 x 8	SRM2016	100/120	30/25	1	24[1,2,3]
8192 x 8	SRM2064	120/150	30/25	1	28[1,2]
8192 x 8	SRM2264L	100/120	47/45	0.5	28[1,2]
32768 x 8	SRM20256L	100/120	40/37	2	28[1,2,4]
131,072 x 8	SRM20100L	70/85/100	45	2	32[1,2,4,5]

(1) Plastic DIP
(2) Small Outline
(3) 300 mil Skinny DIP
(4) TSOP (EIAJ standard) under development
(5) RTSOP (EIAJ standard) under development

S-MOS Systems, Inc. 2460 North First Street San Jose, CA 95131 (408) 922-0200

S-MOS SYSTEMS

A Seiko Epson Affiliate

SONY CXK58258AP/AJ -15/20/25

32,768-word × 8-bit High Speed CMOS Static RAM

Description

The CXK58258AP/AJ is a high speed CMOS static RAM which consists of 32,768-word × 8-bit. It operates at 15/20/25ns access time from 5V single power supply.

Features

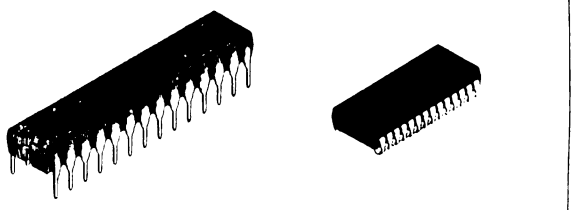
- High speed, low power consumption :

	Access time (Max.)	Power consumption (Typ., Cycle = Min.)
CXK58258AP/AJ-15	15ns	500mW
CXK58258AP/AJ-20	20ns	425mW
CXK58258AP/AJ-25	25ns	375mW

- Single +5V power supply :
  −15 5V ± 5%
  −20/25 5V ± 10%
- Fully static memory···No clock or timing strobe required.
- Equal access and cycle time.
- Directly TTL compatible all inputs and outputs.
- Common data input and output : three state output
- Available in 28 pin 300mil DIP, 300mil SOJ package.

CXK58258AP
28 pin DIP (Plastic)

CXK58258AJ
28 pin SOJ (Plastic)



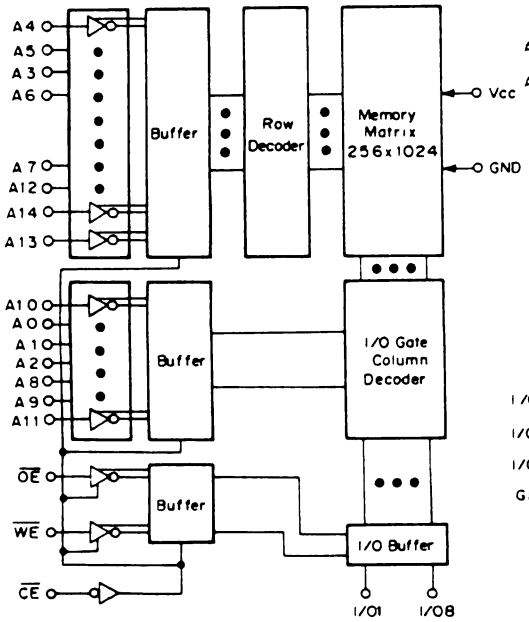
Function

32,768-word × 8-bit static RAM

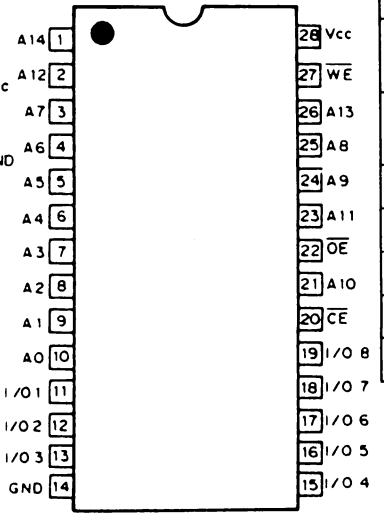
Structure

Silicon gate CMOS IC

Block Diagram



Pin Configuration (Top view)



Pin Description

Symbol	Description
A0 to A14	Address input
I/O1 to I/O8	Data input/output
$\overline{CE}$	Chip enable input
$\overline{WE}$	Write enable input
$\overline{OE}$	Output enable input
Vcc	+5V power supply
GND	Ground

Sony USA•Phone (714)229-4331•Fax (714)229-4333
Sony Canada•Phone (416)499-1414•Fax (416)499-8290

SONY CXK59288P/J -15/20/25

32768-word × 9-bit High Speed CMOS Static RAM

Description

The CXK59288P/J is a high speed CMOS static RAM which consists of 32768-word × 9-bit. It operates at 15ns/20ns/25ns access time from 5V single power supply.

Features

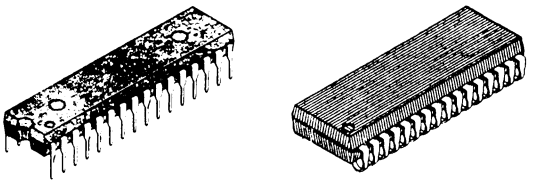
- High speed, low power consumption :

	Access time (Max.)	Power consumption (Typ., Cycle=Min.)
CXK59288P/J-15	15ns	500mW
CXK59288P/J-20	20ns	425mW
CXK59288P/J-25	25ns	375mW

- Single +5V power supply :
  - −15 5V ± 5%
  - −20/25 5V ± 10%
- Fully static memory...No clock or timing strobe required.
- Equal access and cycle time.
- Directly TTL compatible all inputs and outputs.
- Available in 32 pin 300mil DIP, 300mil SOJ package.

CXK59288P
32 pin DIP (Plastic)

CXK59288J
32 pin SOJ (Plastic)



Function

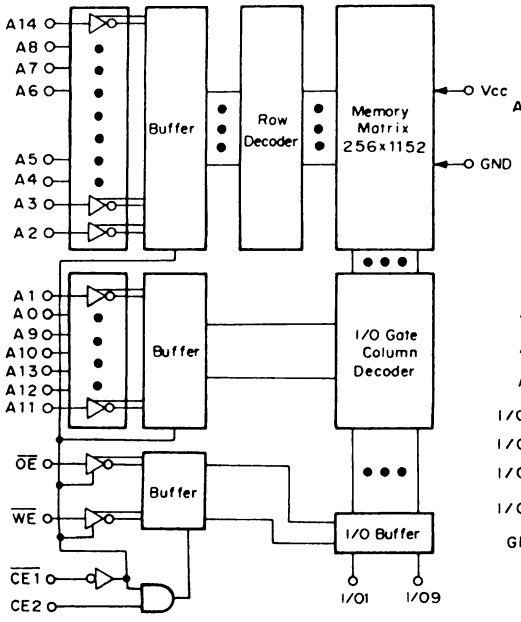
32768-word × 9-bit static RAM

Structure

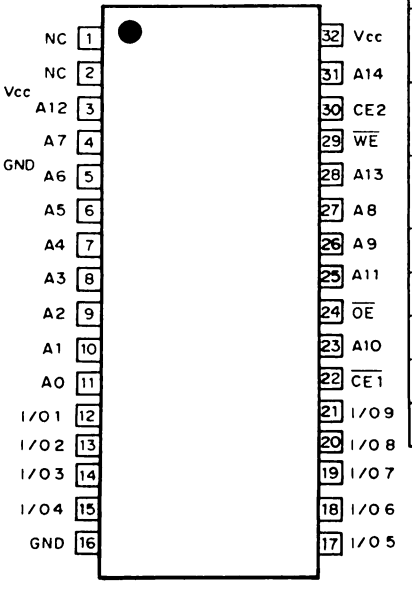
Silicon gate CMOS IC

Sony

Block Diagram



Pin Configuration (Top view)



Pin Description

Symbol	Description
A0 to A14	Address input
I/O1 to I/O9	Data input/output
$\overline{CE1}$, CE2	Chip enable 1, 2 input
$\overline{WE}$	Write enable input
$\overline{OE}$	Output enable input
Vcc	+5V power supply
GND	Ground
NC	Non connection

Sony USA•Phone (714)229-4331•Fax (714)229-4333
Sony Canada•Phone (416)499-1414•Fax (416)499-8290

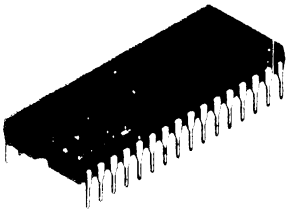
SONY CXK581000P/M -10L/12L/15L -10LL/12LL/15LL

131072-word × 8-bit High Speed CMOS Static RAM

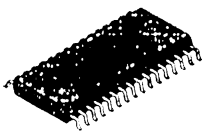
Description

CXK581000P/M is a general purpose high speed CMOS static RAM organized as 131, 072 words by 8 bits. Operating on a single 5V supply, this asynchronous IC is suitable for high speed and low power consumption applications where battery back up for nonvolatility is required.

CXK581000P
32 pin DIP (Plastic)



CXK581000M
32 pin SOP (Plastic)



Features

- Fast access time : (Access time)
  CXK581000P/M-10L/10LL 100ns (Max.)
  CXK581000P/M-12L/12LL 120ns (Max.)
  CXK581000P/M-15L/15LL 150ns (Max.)
- Low power consumption operation :

	Standby	/DC operation
CXK581000P/M-10L, 12L, 15L ;	10 µW (Typ.)	/35mW (Typ.)
10LL, 12LL, 15LL ;	3.5 µW (Typ.)	/35mW (Typ.)

- Single +5V supply : +5V ± 10%
- Fully static memory ··· No clock or timing strobe required.
- Equal access and cycle time.
- Common data input and output:three state output.
- Directly TTL compatible : All inputs and outputs.
- Low voltage data retention : 2.0V (Min.)
- CXK581000P 600mil 32 pin DIP package
  CXK581000M 525mil 32 pin SOP package

Sony

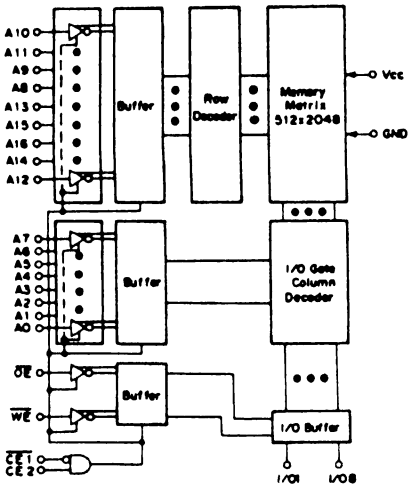
Functions

131,072 word × 8 bit static RAM

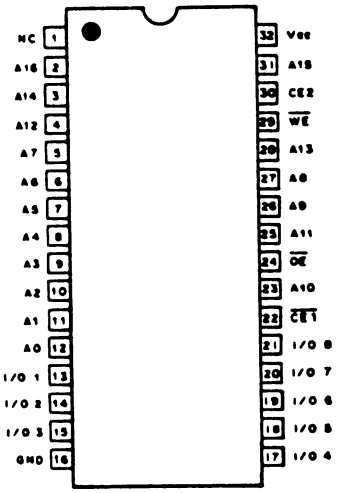
Structure

Silicon gate CMOS IC

Block Diagram



Pin Configuration (Top View)



Pin Description

Symbol	Description
A0 to A16	Address input
I/O1 to I/O8	Data input output
$\overline{CE1}$, CE2	Chip enable 1, 2 input
$\overline{WE}$	Write enable input
$\overline{OE}$	Output enable input
Vcc	Power supply
GND	Ground
NC	No connection

Sony USA ● Phone (714)229-4331 ● Fax (714)229-4333
Sony Canada ● Phone (416)499-1414 ● Fax (416)499-8290

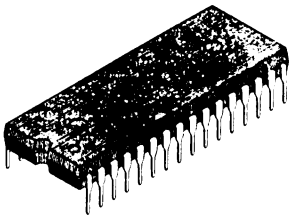
SONY CXK581001P/M -70L/85L 70LL/85LL

131,072-word × 8-bit High Speed CMOS Static RAM

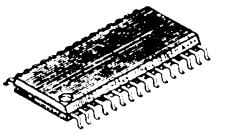
Description

CXK581001P/M is a 1,048,576 bits high speed CMOS static RAMs organized as 131,072 words by 8-bit and operates from a single 5V supply. This IC is suitable for use in high speed and low power applications in which battery back up for nonvolatility is required.

CXK581001P
32 pin DIP (Plastic)



CXK581001M
32 pin SOP (Plastic)



Features

- Fast access time: (Access time)
  CXK581001P/M-70L/70LL 70ns (Max.)
  CXK581001P/M-85L/85LL 85ns (Max.)
- Low power operation :
  CXK581001P/M Standby/Operation
  -70L/85L : 10 µW (Typ.)/237.5mW (Typ., Cycle=Min.)
  -70LL/85LL : 3.5 µW (Typ.)/237.5mW (Typ., Cycle=Min.)
- Single + 5V supply : +5V ± 10%
- Fully static memory... No clock or timing strobe required.
- Equal access and cycle time.
- Common data input and output : three state output.
- Directly TTL compatible : All inputs and outputs.
- Low voltage data retention : 2.0V (Min.)
- CXK581001P 600mil 32 pin DIP package
- CXK581001M 525mil 32 pin SOP package

Function

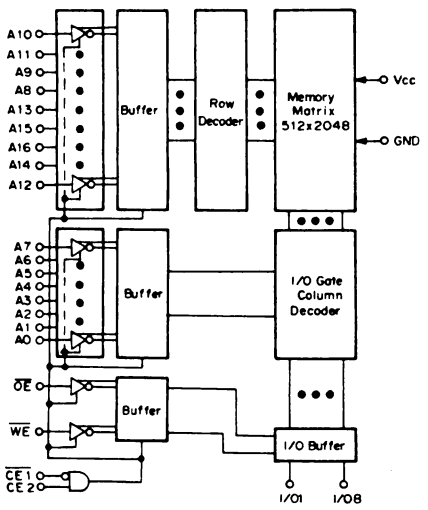
131,072-word × 8-bit static RAM

Structure

Silicon gate CMOS IC

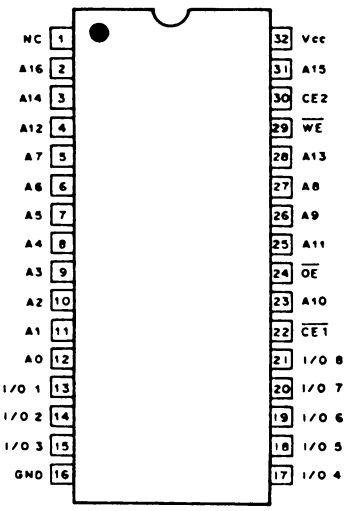
Sony

Block diagram



Pin Configuration

(Top View)



Pin Description

Symbol	Description
A_0 to A_{16}	Address input
I/O1 to I/O8	Data input/output
$\overline{CE1}$, CE2	Chip enable 1, 2 input
$\overline{WE}$	Write enable input
$\overline{OE}$	Output enable input
V_{CC}	+5V power supply
GND	Ground
NC	No connection

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SONY CXK581020SP/J -35/45/55

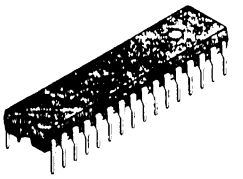
131072-word × 8-bit High Speed CMOS Static RAM

Description

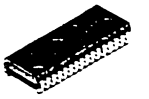
CXK581020SP/J are 131,072-word × 8-bit high speed CMOS static RAMs suitable for use in high speed and low power applications.

Organized as 131,072 words by 8 bits, it operates from a single 5V supply.

CXK581020SP
32 pin DIP (Plastic)



CXK581020J
32 pin SOJ (Plastic)



Features

- Fast access time : (Access time)
  CXK581020SP/J-35 35ns (Max.)
  CXK581020SP/J-45 45ns (Max.)
  CXK581020SP/J-55 55ns (Max.)
- Low power operation : (Standby) (Operation)
  CXK581020SP/J-35, 45, 55
  50 µW(Typ.) 150mW(Typ.)
- Single +5V supply : +5V ± 10%
- Fully static memory ··· No clock or timing strobe required.
- Equal access and cycle time.
- Directly TTL compatible : All inputs and outputs.
- Available in 32 pin 400-mil DIP and 400-mil SOJ

Function

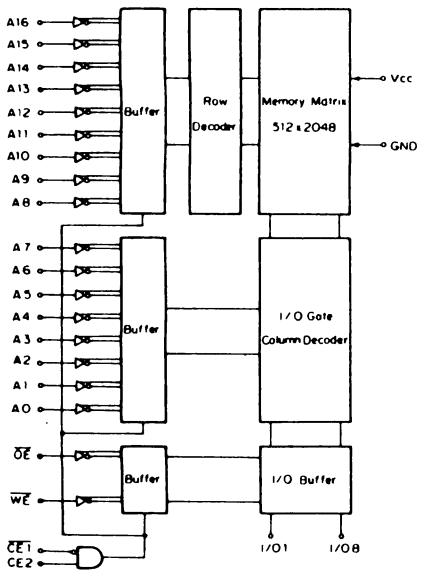
131,072-word × 8-bit static RAM

Structure

Silicon gate CMOS IC

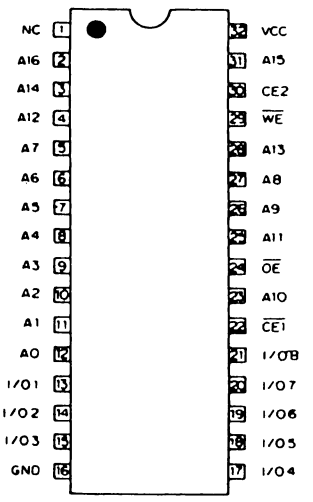
Sony

Block Diagram



Pin Configuration

(Top View)



Pin Description

Symbol	Description
A0 to A16	Address input
I/O1 to I/O8	Data input output
$\overline{CE1}$, CE2	Chip enable 1, 2 input
$\overline{WE}$	Write enable input
$\overline{OE}$	Output enable input
Vcc	+5V Power supply
GND	Ground
NC	No connection

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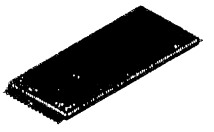
SONY CXK581100TM/YM -10L/12L/15L -10LL/12LL/15LL

131072-word × 8-bit High Speed CMOS Static RAM

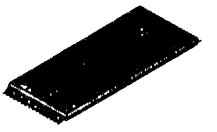
Description

CXK581100TM/YM is a 1M bits, 131072 words by 8 bits, CMOS static RAM. It is suitable for portable and battery back-up systems which require extremely small package and low stand-by current.

CXK581100TM
32 pin TSOP (Plastic)



CXK581100YM
32 pin TSOP (Plastic)



Features

- Thin Small-outline Packages of EIAJ standard :
  CXK581100TM :
  8mm × 20mm 32 pin TSOP
  CXK581100YM :
  8mm × 20mm 32 pin TSOP (Mirror image pinout)
- Low stand-by current :
  L-Version :
  100 μA (Max.) @Vcc=5.5V, Ta=0 to 70℃
  LL-Version :
  20 μA (Max.) @Vcc=5.5V, Ta=0 to 70℃
- Low voltage data retention : 2.0V (Min.)
- Fast access time : (Access time)
  CXK581100TM/YM-10L, -10LL 100ns (Max.)
  CXK581100TM/YM-12L, -12LL 120ns (Max.)
  CXK581100TM/YM-15L, -15LL 150ns (Max.)
- Single +5V Supply : +5V ± 10%

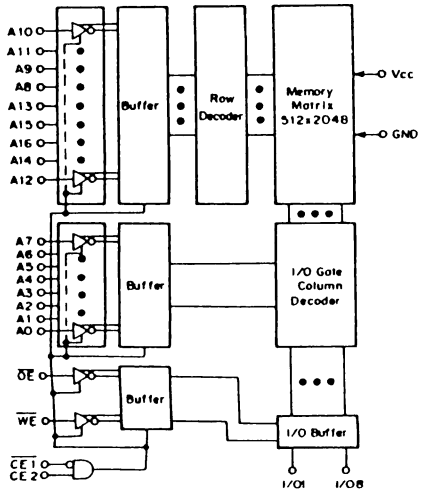
Function

131072-word × 8-bit static RAM

Structure

Silicon gate CMOS IC

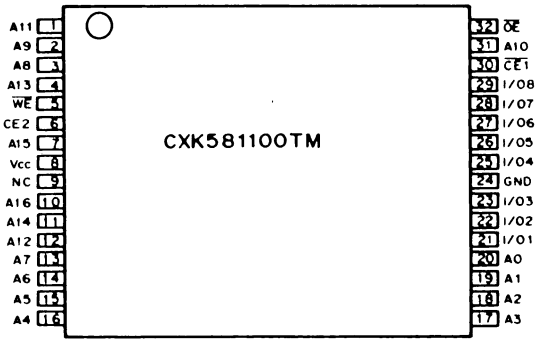
Block Diagram

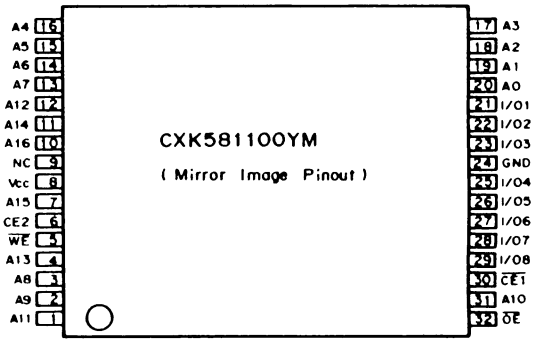


Pin Description

Symbol	Description
A0 to A16	Address input
I/O1 to I/O8	Data input/output
$\overline{CE1}$, CE2	Chip enable 1, 2 input
$\overline{WE}$	Write enable input
$\overline{OE}$	Output enable input
V_{CC}	+5V power supply
GND	Ground
NC	No connection

Pin Configuration (Top View)





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Sony

SONY CXK584000P/M/TM/YM-70L/85L/10L/12L

Preliminary

524,288-word x 8-bit High Speed CMOS Static RAM

Description

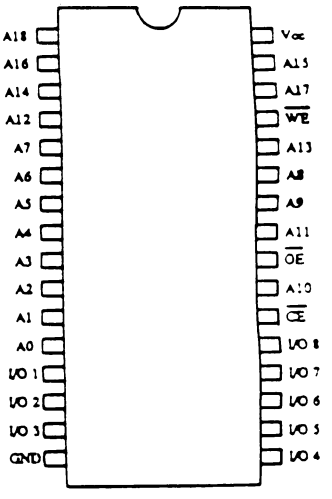
CXK584000P/M/TM/YM is a 4,194,304 bits high speed CMOS Static RAM organized as 524,288 words by 8-bits. Operating on a single 2.7 to 5.5 supply, this asynchronous IC is suitable for high speed and low power consumption applications where battery back up for nonvolatility is required.

Features

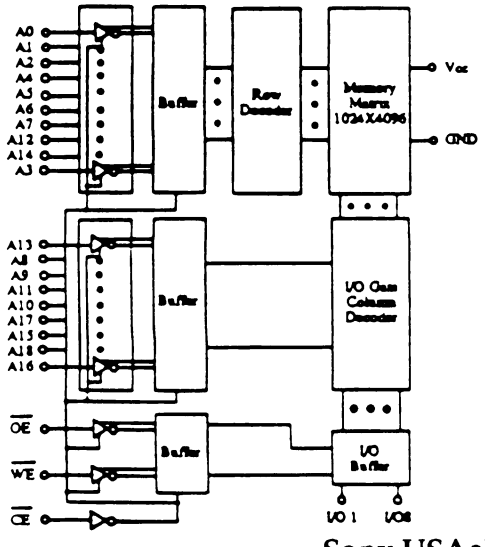
- Wide supply voltage range: 2.7 to 5.5V
- Fast access time: 5V operation/3V operation
  - CXK584000P/M/TM/YM-70L 70ns (Max.)/140ns (Max.)
  - CXK584000P/M/TM/YM-85L 85ns (Max.)/170ns (Max.)
  - CXK584000P/M/TM/YM-10L 100ns (Max.)/200ns (Max.)
  - CXK584000P/M/TM/YM-12L 120ns (Max.)/240ns (Max.)
- Low power consumption operation: 5V operation/3V operation
  - Standby 10uW(Typ.)/3uW (Typ.)
  - DC operation 45mW (Typ.)/1.2mW (Typ.)
- Full static memory...No clock or timing strobe required.
- Equal access and cycle time.
- Common data input and output: three state output.
- Directly TTL Compatible: All inputs and outputs.
- Low voltage data retention: 2.0V (Min.)
  - CXK584000P 600mil 32pin DIP package
  - CXK584000M 525mil 32pin SOP package
  - CXK584000TM/YM 400mil 32pin TSOP (Type II) package

Pin Configuration (Top View)

(Please see mirror image for CXK584000YM)



Block Diagram



Pin Description

Symbol	Description
A0-A18	Address input
I/O1 to I/O8	Data input output
$\overline{CE}$	Chip enable input
$\overline{WE}$	Write enable input
$\overline{OE}$	Output enable input
Vcc	Power supply
GND	Ground

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SONY CXK584001P/M/TM/YM-10L/12L

Preliminary

524,288-word x 8-bit High Speed CMOS Static RAM

Description

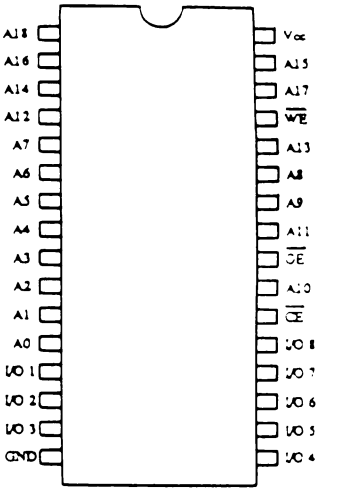
CXK584001P/M/TM/YM is a 4,194,304 bits high speed CMOS Static RAM organized as 524,288 words by 8-bits. Operating on a single 3.0V (3.3V) supply, this asynchronous IC is suitable for low voltage microsystems where battery operation is required.

Features

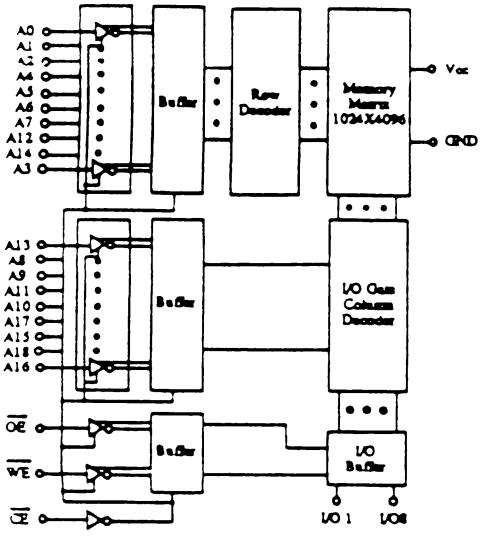
- Single +3V (+3.3V) supply :3V (3.3V) ±10%
- Fast access time:
  - CXK584001P/M/TM/YM-10L 100ns (Max.)
  - CXK584001P/M/TM/YM-12L 120ns (Max.)
- Low power consumption operation:
  - Standby 3uW (Typ. @3V)
  - DC operation 1.2mW (Typ. @3V)
- Full static memory...No clock or timing strobe required.
- Equal access and cycle time.
- Common data input and output: three state output.
- Directly TTL compatible: All inputs and outputs.
- Low voltage data retention: 2.0V(Min.)
  - CXK584001P 600mil 32pin DIP package
  - CXK584001M 525mil 32pin SOP package
  - CXK584001TM/YM 400mil 32pin TSOP (Type II) package

Pin Configuration (Top View)

(Please see mirror image for CXK584001YM)



Block Diagram



Pin Description

Symbol	Description
A0-A18	Address input
I/O1 to I/O8	Data input output
$\overline{CE}$	Chip enable input
$\overline{WE}$	Write enable input
$\overline{OE}$	Output enable input
Vcc	Power supply
GND	Ground

Sony

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SONY CXK77910J -17/20

131072 words × 9-bit Self-Timed Static Random Access Memory *Preliminary*

Description

The CXK77910J is a 1,179,648 bit Self-Timed Static Random Access Memory organized as 128K words by 9 bits. This STRAM integrates Input Registers, High Speed SRAM and Output Registers onto a single monolithic circuit. All Registers are triggered with the positive edge of an external clock (CLK). At the positive edge of CLK, the RAM data of the previous CLK cycle is presented. Write operation is initiated by the positive edge of CLK and internally self-timed. This feature eliminates complex off-chip write pulse generation and provides increased flexibility for incoming signals.

Function

There are three possible user transactions with the STRAM. (Read operation, write operation and deselect operation.)

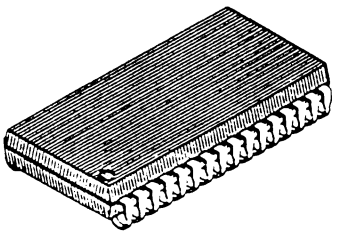
The read operation requires $\overline{WE}$="HIGH" and $\overline{OE}$=$\overline{CE}$="low" on the positive edge of CLK.
The memory location pointed to by the contents of the Address registers is read internally and the contents of the location are captured in the Data-out registers on the next positive edge of CLK. The state of Data-out will reflect the contents of the Data-out registers.

The write operation requires $\overline{CE}$=$\overline{WE}$="LOW" on the positive edge of CLK. The memory location pointed to by the contents of the Address registers is written with the contents of the Data-in registers. The write operation is entirely self-timed, eliminating critical timing edges.

The deselect cycle requires $\overline{CE}$="HIGH" or $\overline{OE}$=$\overline{WE}$="HIGH" on the positive edge of CLK. Write operation and internal read operation are disabled during the clock cycle. The data outputs are forced to a high impedance state during the next clock cycle. During the deselect cycle by $\overline{CE}$="HIGH", STRAM turns to power down mode.

The write cycle needs three preceding deselect cycles since the data for the write cycle must be supplied to I/O terminals during high impedance state. But immediately after power-on of the STRAM, the write operation can start on the first positive edge of CLK since the I/O terminals are initialized to be in high-impedance state.

32 pin SOJ (Plastic)



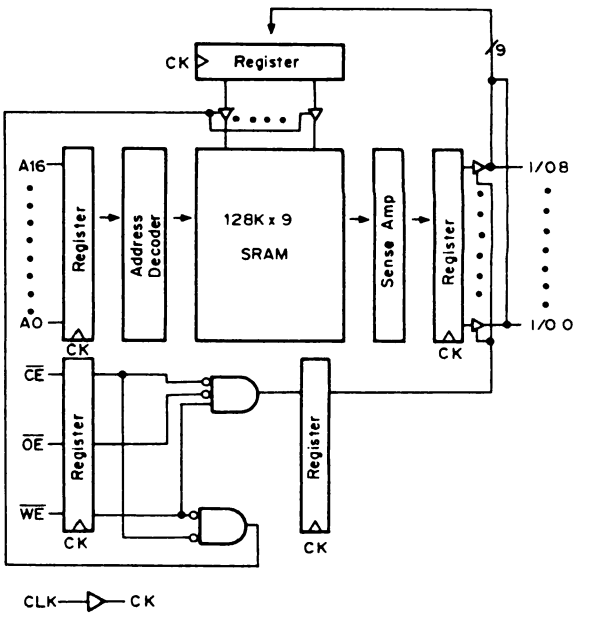
Features

- Fast Cycle Time: (Cycle) (Frequency)
  CXK77910J-17 16.6ns 60MHz
  CXK77910J-20 20.0ns 50MHz
- Fast Clock to Data Valid
  CXK77910J-17/20 10ns
- Available in Plastic 32 pin 400mil SOJ
- All inputs and outputs registered with clock
- Direct TTL compatible
- Low power consumption (min. cycle, 100% duty)
  CXK77910J-17/20 715mW (Max.)

Structure

Silicon gate CMOS IC

Block Diagram



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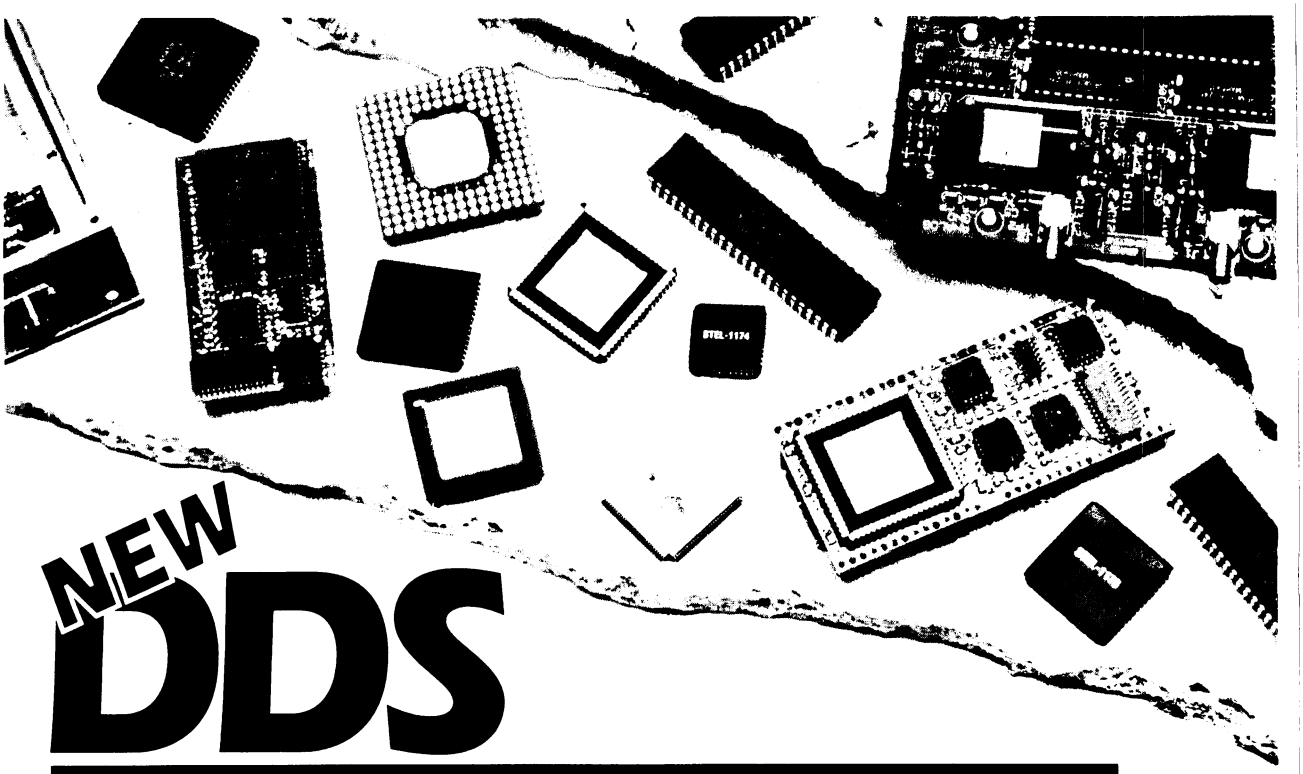

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STEL-1176	80 MHz, BCD/Decimal, High Speed CMOS
STEL-1177	60 MHz, 32-bit, full PM, FM, & Quadrature
STEL-1178A	50 MHz, 32-bit, Dual NCO with phase modulation NEW
STEL-1180	50 MHz, 32-bit, chirp generating NCO NEW
STEL-1179	25 MHz, Serial Input PM NCO, $5 in commercial quantities NEW
STEL-2172	300 MHz, ECL, 32-bit
STEL-2173	1 GHz, GaAs, 32-bit, BPSK, QPSK

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STEL-1272	based on 1172B, 0-20 MHz
STEL-1273	based on 1173, 0-20 MHz
STEL-1275	based on 1175, 0-25 MHz
STEL-1375A	miniature assembly based on 1175 MIL Spec version now available NEW
STEL-1376	miniature assembly based on 1176
STEL-1377	miniature assembly based on 1177 MIL Spec version now available NEW
STEL-1378	miniature assembly based on 1178A NEW
STEL-1277	based on 1177, 0-25 MHz
STEL-2272	based on 2172, 0-130 MHz
STEL-2273	based on 2173, 0-400 MHz
STEL-2373	based on 2173, 0-400 MHz - miniature hybrid NEW

CHASSIS-LEVEL DDS

STEL-9272	300 MHz Synthesizer based on 2172
STEL-9273	1 GHz Synthesizer based on 2173
STEL-9275	Synthesizer with 1 GHz internal clock NEW

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HIGHEST PERFORMANCE VITERBI DECODER

At 20 Mbps with 4-bit soft decision the STEL-2020 is the highest performance K=6 and K=7 Viterbi decoder in the industry.

HIGHEST FLEXIBILITY PN CODER

At 30 Mcps and up to 32 taps per coder the STEL-1032 Triple PN Coder has the flexibility to generate a wide variety of codes for many spread spectrum applications.

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The STEL-3310 64-Tap Complex Matched Filter provides the highest performance in a single package for signal despreading applications.

GPS CODER

The STEL-1023 generates the C/A (Clear/Acquisition) coding and timing for GPS receivers in a single chip.

LOWEST PRICE VITERBI DECODER

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HIGHEST SPEED ACCUMULATOR

With a 70 Msamples/sec. accumulation rate the STEL-2410 is the industry's highest speed signal accumulator for spread spectrum applications.

HIGHEST PERFORMANCE BIT SYNCHRONIZER/ DEMODULATOR

The STEL-2110A is a digital bit synchronizer and PSK demodulator, providing high performance in spread spectrum BPSK and QPSK applications.

FASTEST BURST DATA ACQUISITION

The STEL-2210 Block Phase Estimator allows burst signals to be acquired rapidly and demodulated coherently when used in conjunction with the STEL-2110A.

HIGHEST PERFORMANCE QUADRATURE NCO

The STEL-1177 Quadrature NCO has a 60 MHz clock frequency and incorporates linear PM and FM capabilities as well as providing quadrature 12-bit outputs for –75 dBc purity.

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SYNERGY SEMICONDUCTOR

COMPANY OVERVIEW

Synergy Semiconductor, a leader in the high-performance ECL market, designs and manufactures the industry's fastest memory and logic products. Synergy utilizes a unique proprietary process, combined with design innovations, to provide the very best in *ULTRA-FAST USABLE SPEED℠* products.

A key factor in the company's early success has been the *synergy* between a highly experienced and motivated team, in-house wafer fabrication and state-of-the-art technology and test capabilities. These components will continue to keep Synergy in the forefront of the high-performance market.

Technology

Synergy has implemented a world leadership bipolar-based technology which incorporates the most advanced process modules and isolation techniques to produce the industry's fastest speeds at lower power levels than previously achievable. Unlike other bipolar technologies, Synergy's proprietary ASSET™ (All Spacer Separated Element Transistor) Technology is optimized to produce both memory and logic products offering superior performance compared to all domestic and international competitors.

Synergy's patented architectural innovations produce significant customer benefits in both performance and density:

- Spacers allow element (i.e., base/emitter/collector) separations to be determined by the thickness of a film rather than by a lithographic space, resulting in a dramatic reduction in element separation;
- ASSET's trench isolation results in transistors which are 40% smaller than competitive transistors produced under similar lithographic conditions.

Initial products are produced with a very conservative 1.5μ implementation of ASSET Technology, ensuring manufacturability while providing leadership performance: devices which achieve an fT of 18GHz; unloaded gate delays of 80ps at just 200μA.

ASSET is a fully self-aligned technology which is scalable to submicron levels. Using the recently-developed 1.2μ version of ASSET, Synergy is producing a 16Kx4 RAM and an Advanced Self-Timed 2Kx9 RAM. During 1992, Synergy will also introduce (1) the first products designed in its ASSET-based BiCMOS and (2) ASSET II technology offering further advancements in density and performance.

The result of combining Synergy's patented circuit design and processing technologies is the highest-performance, manufacturable system solutions.

Products

Synergy currently offers a complete series of ultra-fast 1K, 4K, 16K and 64K ECL SRAMs, the ECLinPS Logic Family and the Super-300K™ Logic Family, each of which have set new speed standards for the industry. The fastest speed grades currently offered on the SRAM series are 3ns 1K/4K and 5ns 16K/64K. A unique competitive advantage of Synergy's SRAMs is their equally fast read and write times; further, the SRAMs are designed for alpha-particle immunity and have achieved excellent results in both accelerated and long-term in-situ alpha tests.

Synergy's ECL logic products also offer the best performances in the industry while incorporating additional customer benefits including tighter skews, 2000V ESD protection and all I/O options (10KH/100K/101K).

Also recently introduced is a 2Kx9 Advanced Self-Timed SRAM which is compatible with National's NM100492/NM4492. Additionally, each quarter will see the release of additional ECLinPS logic devices, some of which will be proprietary.

In conjunction with a major industry partner, the company is currently developing three new very-high-speed product lines:

- RAM-Intensive System Element (RISE™) Family
- Universal System Element (USE™) Family
- Application-Specific Standard Product (ASSP) Family

The goal is to produce devices of highest user value which substantially out-perform competitive products and pave the way for systems with clock frequencies well above 50MHz.

Synergy will continue developing unique and complementary product families which will increase the usable speed available to the high-performance system designer.

Strategic Alliance

Ever mindful of its overriding commitment to serve its customers with the most innovative solutions, Synergy Semiconductor has entered into a comprehensive strategic alliance with Toshiba Corporation. This strategic alliance incorporates four closely-linked agreements:

- a joint R&D pact,
- a manufacturing agreement,
- a technology licensing agreement, and
- an equity investment.

Under terms of the manufacturing agreement, Toshiba will provide Synergy with the use of a new high-volume (6-inch, submicron) IC fabrication line, which will process Synergy's high-performance bipolar ASSET and BiCMOS technologies. This fab will allow Synergy to utilize world class manufacturing capabilities to produce its current SRAM and logic products, as well as future products.

Through its equity investment in Synergy, Toshiba has recognized Synergy's leadership in bipolar-based process and design technologies. Toshiba is a minority shareholder (<10%).

Facilities

Synergy is headquartered in Santa Clara, California. The company's operations are housed in a 48,000 square foot facility which incorporates all aspects of its business from research and development to design, wafer fabrication, test, shipping and administration. The facility incorporates a 7,000 square foot modern wafer fabrication clean room with equipment operating in a sub-Class 20 environment. The fabrication area incorporates state-of-the-art high resolution steppers, dry etchers, films deposition systems, etc. The company's test area utilizes advanced test equipment capable of holding uniquely tight picosecond level testing accuracies.

Synergy Semiconductor Corporation, 3450 Central Expressway, Santa Clara, CA 95051 Tel: 800-788-3297 FAX: 408-737-0831

SYNERGY SEMICONDUCTOR

ECL RAMs

ULTRA-FAST USABLE SPEED℠

FEATURES

- Ultra-fast access times
- Ultra-fast write times
- Eliminates write recovery glitch found on competitors' ECL RAMs
- Designed for alpha particle immunity
- Built with ASSET™ technology
- Fully compatible with industry standard 10K and 100K ECL power supply and I/O levels
- Extended supply voltage option:
  — 100K = –4.5V with 100K I/O
  — 101K = –5.2V with 100K I/O
- 1500V ESD protection
- Industry standard architecture and pinouts

Part Number	Description	Data Sheet Limits (ns)		Min. mA	Avail.
		t_{AA}	t_{WW}	I_{EE}	
SY10/100/101422-3/4	256 x 4 ECL RAM	3/4	3/4	–270	NOW
SY10/100/101422-5/6	256 x 4 ECL RAM	5/6	3.5/5	–200	NOW
SY10/100/101474-3/4	1K x 4 ECL RAM	3/4	3/4	–300	NOW
SY10/100/101474-5/6	1K x 4 ECL RAM	5/6	5/6	–220	NOW
SY10/100/101480-6	16K x 1 ECL RAM	6	6	–220	NOW
SY10/100/101480-8/10	16K x 1 ECL RAM	8/10	10	–260/–220	NOW
SY10/100/101484-3.5	4K x 4 ECL RAM	3.5	3.5	–350	Q1'92
SY10/100/101484-4/5/6	4K x 4 ECL RAM	4/5/6	4/5/6	–350	NOW
SY10/100/101484-8/10	4K x 4 ECL RAM	8/10	10	–260	NOW
SY10/100/101492-5/6/7	2K x 9 Advanced STRAM ECL RAM	5/6/7	5/6/7	500/450/300	NOW
SY10/100/101494-5/6	16K x 4 ECL RAM	5/6	5/6	–395	NOW

LOW POWER ECL RAMs

Part Number	Description	Data Sheet Limits (ns)		Min. mA	Avail.
		t_{AA}	t_{WW}	I_{EE}	
SY10/100/101422L-4/5/7	256 x 4 ECL RAM	4/5/7	4/5/7	–150	NOW
SY10/100/101474L-4/5/7	1K x 4 ECL RAM	4/5/7	4/5/7	–180	NOW
SY10/100/101484L-7/8/10	4K x 4 ECL RAM	7/8/10	7/8/10	–180	NOW
SY10/100/101494L-7/8/10	16K x 4 ECL RAM	7/8/10	7/8/10	–180	NOW

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Synergy Semiconductor

SYNERGY SEMICONDUCTOR

ECLIPS

ULTRA-FAST ECL LOGIC

FEATURES

- Ultra-fast gate speeds for performance-oriented ECL systems
- 100% compatible with Motorola
- Packaged in efficient high-performance 28-lead PLCC
- Superior ESD protection of 2000V
- Typical edge rates of 500ps
- Industry standard 10KH and 100K I/O levels
- 101K offers extended supply voltage option with 100K compensation and interface standards
  — V_{EE} = –5.2V (101K)

Part Number	Description	Max. Speed	10KH IEE Max. mA	100K/101K IEE Max. mA	Avail.
SY10/100/101E016	8-Bit Synchronous Binary Up Counter	700MHz	181	208	NOW
SY10/100/101E101	Quad 4-Input OR/NOR Gate	500ps	36	42	NOW
SY10/100/101E104	Quint 2-Input AND/NAND Gate	600ps	50	58	NOW
SY10/100/101E107	Quint 2-Input XOR/NOR Gate	600ps	50	58	NOW
SY10/100/101E111	1:9 Differential Clock Driver	630ps	60	69	NOW
SY10/100/101E112	Quad Driver with Enable	600ps	56	65	NOW
SY10/100/101E116	5-Bit Differential Line Receiver	500ps	35	40	NOW
SY10/100/101E122	9-Bit Buffer	500ps	56	63	NOW
SY10/100/101E131	4-Bit D Flip-Flop	800MHz	70	81	NOW
SY10/100/101E136	6-Bit Universal Counter	700MHz	180	210	1Q'92
SY10/100/101E137	8-Bit Ripple Counter	1.2GHz	180	210	1Q'92
SY10/100/101E141	8-Bit Shift Register	700MHz	168	193	NOW
SY10/100/101E142	9-Bit Shift Register	700MHz	145	165	NOW
SY10/100/101E143	9-Bit Hold Register	700MHz	145	165	NOW
SY10/100/101E150	6-Bit Latch	800ps	60	69	NOW
SY10/100/101E151	6-Bit D Register	800MHz	85	98	NOW
SY10/100/101E154	5-Bit 2:1 Mux-Latch	825ps	91	105	NOW
SY10/100/101E155	6-Bit 2:1 Mux-Latch	825ps	102	117	NOW
SY10/100/101E156	3-Bit 4:1 Mux-Latch	950ps	90	103	NOW
SY10/100/101E157	Quad 2:1 Mux, Individual Select	500ps	38	44	NOW
SY10/100/101E158	5-Bit 2:1 Multiplexer	600ps	40	46	NOW
SY10/100/101E160	12-Bit Parity Generator/Checker	900ps	69	79	NOW
SY10/100/101E163	Dual 8-Input Multiplexer	850ps	88	100	NOW
SY10/100/101E164	16:1 Multiplexer	850ps	71	81	1Q'92
SY10/100/101E166	9-Bit Magnitude Comparator	1400ps	120	120	NOW
SY10/100/101E167	6-Bit 2:1 Mux-Register	800MHz	113	130	NOW

Synergy Semiconductor

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ULTRA-FAST ECL LOGIC (cont'd.)

Part Number	Description	Max. Speed	10KH IEE Max. mA	100K/101K IEE Max. mA	Avail.
SY10/100/101E171	3-Bit 4:1 Multiplexer	725ps	67	77	NOW
SY10/100/101E175	8-Bit Error Detection/Correction (EDAC)	1400ps	120	120	NOW
SY10/100/101E193	8-Bit EDAC/Parity	700ps	134	155	1Q'92
SY10/100/101E195	Programmable Delay Chip	1800ps	156	179	NOW
SY10/100/101E196	Programmable Delay Chip & Analog	1800ps	156	179	NOW
SY10/100/101E212	3-Bit Scannable ECL Driver	800ps	96	110	1Q'92
SY10/100/101E241	8-Bit Scannable Register	700MHz	168	193	NOW
SY10/100/101E256	3-Bit 4:1 Mux-Latch	950ps	83	96	NOW
SY10/100/101E336	3-Bit Registered Bus XVCR	1000ps	122	141	NOW
SY10/100/101E337	3-Bit Scannable Register Bus XCVR	1000ps	161	185	NOW
SY10/100/101E404	Quad High Frequency Diff. AND	700ps	127	146	1H'92
SY10/100/101E416	Quint High Frequency Line Receiver	600ps	162	186	1H'92
SY10/100/101E431	3-Bit Diff. Set/Rest Flip-Flop	1100MHz	132	152	1H'92
SY10/100/101E446	4:1 Parallel/Serial Connector	2.5Gb/s	N/A	N/A	1H'92
SY10/100/101E451	6-Bit D-Reg., Diff. Data & CLK Inputs	800MHz	101	116	NOW
SY10/100/101E452	5-Bit D-Reg., Diff. Data, CLK & Q	1100ps	89	102	1Q'92
SY10/100/101E457	Triple High Frequency Diff. 2:1 Mux	700ps	110	127	NOW

Synergy Semiconductor

ULTRA-FAST ECL/TTL LEVEL TRANSLATORS

Part Number	Translator Description	Max. Speed (D to Q)	Available
SY100/101S324	Hex TTL-to-ECL Translator	1.3ns	NOW
SY100/101S325	Hex ECL-to-TTL Translator	2.6ns	NOW

Consult factory on military versions in flatpacks.

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SYNERGY SEMICONDUCTOR

SUPER-300K™

ULTRA-FAST ECL LOGIC

FEATURES

- Ultra-fast gate speeds for performance-oriented ECL systems
- SUPER-300K devices are pin-compatible with National and Signetics F100K and National 300K
- SUPER-300K devices offer almost twice the speed at similar power of 300K
- SUPER-300K functions offer almost twice the speed and half the power of F100K functions from National and Signetics
- SUPER-300K devices packaged in CERDIP, CERPACK and also in PLCC
- Superior ESD protection of 2000V
- Typical edge rates of 500ps
- Fully compatible with industry standard 100K ECL power supply and I/O levels
- Extended supply voltage option:
  — 100K = –4.5V with 100K I/O
  — 101K = –5.2V with 100K I/O

Part Number	Description	Max. Speed			IEE	Avail.
		DIP	Flat	PLCC	Min. mA	
SY100/101S301	Triple 5-input OR/NOR Gate	900ps	750ps	700ps	–25	NOW
SY100/101S302	Quint 2-Input OR/NOR Gate	800ps	750ps	700ps	–45	NOW
SY100/101S304	Quint AND/NAND Gate	1250ps	1150ps	1050ps	–60	NOW
SY100/101S307	Quint Exclusive OR/NOR Gate	1200ps	1100ps	1000ps	–58	NOW
SY100/101S313	Quad Driver	950ps	850ps	850ps	–70	NOW
SY100/101S314	Quint Differential Line Receiver	1200ps	1100ps	1000ps	–60	NOW
SY100/101S317	Triple 2-Wide OA/OAI Gate	1750ps	1600ps	1500ps	–48	NOW
SY100/101S318	5-Wide 5,4,4,4,2 OA/OAI Gate	1300ps	1100ps	1000ps	–55	NOW
SY100/101S321	9-Bit Inverter	750ps	700ps	700ps	–35	NOW
SY100/101S322	9-Bit Buffer	900ps	800ps	700ps	–63	NOW
SY100/101S324	Hex TTL-to-ECL Translator	1.5ns	1.4ns	1.3ns	–55	NOW
SY100/101S325	Hex ECL-to-TTL Translator	2.8ns	2.7ns	2.6ns	–37	NOW
SY100/101S331	Triple D Flip-Flop	600MHz	700MHz	700MHz	–90	NOW
SY100/101S336	4-Stage Counter/Shift Register	500MHz	500MHz	500MHz	–170	NOW
SY100/101S341	8-Bit Shift Register	500MHz	500MHz	500MHz	–145	NOW
SY100/101S350	Hex D Latch	1050ps	1000ps	900ps	–98	NOW
SY100/101S351	Hex D Flip-Flop	600MHz	700MHz	700MHz	–98	NOW
SY100/101S355	Quad Multiplexer/Latch	1300ps	1200ps	1100ps	–80	NOW
SY100/101S360	Dual Parity Checker/Generator	2400ps	2300ps	2200ps	–60	NOW
SY100/101S363	Dual 8-Input Multiplexer	1100ps	1000ps	900ps	–92	NOW
SY100/101S364	16-Input Multiplexer	1500ps	1400ps	1300ps	–63	NOW
SY100/101S366	9-Bit Comparator	2200ps	2100ps	2000ps	–150	NOW
SY100/101S370	Universal Demux/Decoder	1300ps	1200ps	1200ps	–95	NOW
SY100/101S371	Triple 4-Input Multiplexer w/Enable	1200ps	1100ps	1000ps	–92	2Q'92

Synergy Semiconductor

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SYNERGY SEMICONDUCTOR

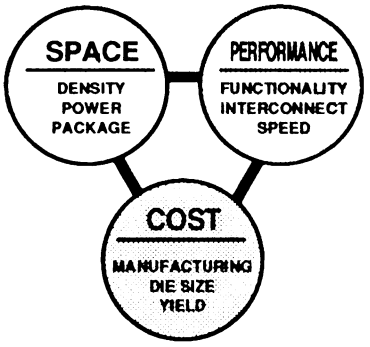
SYSTEM ELEMENTS™ BP-Series

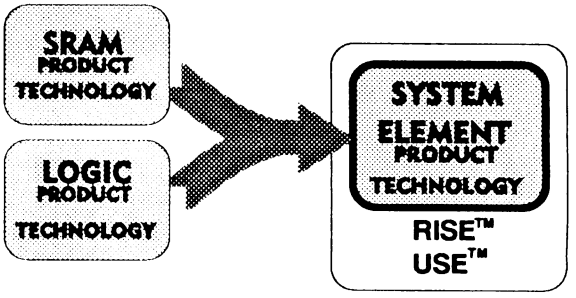
PRODUCT OVERVIEW

Ever mindful of our overriding commitment to continually serve our customers with the most innovative high-performance solutions, Synergy Semiconductor now offers to Systems Designers a completely *new generation* of architectural building blocks:

SYNERGY SYSTEM ELEMENTS.

By combining our ultra-fast, dense, *proven* SRAM product technology onto the same piece of silicon with our high-speed, high-density logic technology--at surprisingly low power dissipation--Synergy moves another step ahead of its competition in the evolution of high-performance solutions ! By simultaneously addressing the three "Imperatives of High-Performance Systems," Synergy System Elements provide a dimension of system design integration never-before possible.





- Fast, dense, proven embedded SRAM (3ns)
- Logic on same chip - - reduced interconnect delays
- Density approaching hand-crafted
- Ultra-fast speed - - 70ps gates
- Lower power than competing products
- Interface flexibility - - ECL/TTL I/O & analog capabilities
- Major second source

SYSTEM ELEMENT ORGANIZATION

Memory Blocks

The six SRAM blocks are direct functional and topological equivalents to Synergy's SY10/100474 ECL SRAM---the world's fastest 4K memory! Each block features independent address, data & control lines, allowing the user the greatest flexibility. Both synchronous & asynchronous operation is facilitated: data inputs & all control lines are latched on the rising edge of the clock (CLK); if CLK is held low, latches are transparent & all operations are asynchronous. In the synchronous mode, the RAM can cycle continuously at 333MHz.

Logic Cells

System Elements use a 6-transistor cell, arranged in an innovative OCEAN OF CELLS™, which eliminates "routing channels". Synergy's *All Spacer-Separated Element Transistor* (ASSET™) technology, coupled with an innovative (pat. pend.) transistor structure, produce several significant advantages: very small, very fast (17GHz) devices; high device/device isolation; & high interconnect density/routing efficiency. Logic macros are normally implemented by combining horizontally adjacent cells..

I/O Cells

Each cell contains bonding pad, input protection, & configurable circuitry to accomodate a variety of standard logic families. I/O levels conform to 10K standards at -5.2V, and to 100K standards at -4.5V & -5.2V (Vee). Additionally, I/Os located at the left & right sides of the die may be optionally configured for TTL levels; TTL I/Os are implemented in groups of 18 pins (eg: left=18, right=0; l=18, r=18; l=0, r=36; etc.)

Using these three building block types, new "base die" may be custom-configured to meet a customer's special requirements. Contact factory for further details.

Analog Zone (optional)

Yet another benefit of the OCEAN OF CELLS architecture is the ability to craft the individual ASSET transistors and available resistors into simple *analog* functions, further reducing external circuitry. In close cooperation with Synergy's in- house applications engineers, such functions as comparators, phase-locked loops, and/or 2-6 bit analog-to-digital converters may be implemented. Special care must be taken to insure testability and adequate digital/analog isolation. Contact the factory for further information.

SPEED/POWER PROGRAMMABILITY

To provide the designer with the greatest flexibility, each logic macro may be programmed for one of five *discrete* current-source/emitter-follower drive combinations. No chip rerouting is necessitated when changing current levels ! Synergy's PEP/P™ design tool allows the designer to immediately evaluate the propogation delay impact of various current drives; hence, overall power is minimized, and critical path(s) speed is maximized The speed/power options are initially assigned during schematic capture; default option is lowest current.

DESIGN TOOLS

Synergy's highly-integrated design environment (DAVE™) provides the bipolar system designer with unprecedented levels of flexibility and completeness in a highly "engineer-friendly" framework. This open system, based on the Cadence tool suite, features highly-accurate timing models. Synergy offers the customer a range of technical support services, up to (and including) complete "turnkey" designs on both RISE and USE devices.

Synergy Semiconductor Corporation, 3450 Central Expressway, Santa Clara, CA 95051 FAX (408) 737-0831 Phone (408) 730-1313

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SYNERGY SEMICONDUCTOR

RAM-INTENSIVE SYSTEM ELEMENT (RISE™)

Preliminary
SY9BP6R4
Preliminary

DESCRIPTION

The SY9BP6R4 RAM-Intensive System Element is a member of Synergy's new System Element family. Fabricated in the ASSET™ I bipolar process , these high-performance VLSI components offer an unprecedented combination of circuit density, ultra-fast memory, and minimal propagation delay logic---while dissipating significantly less power than competing products.

The SY9BP6R4 features six independent blocks of 3ns SRAM (each organized as 1K-words-by-4-bits), plus 13,600 equivalent 2-input gates of 70ps logic. The 144 I/O pins may be configured with all pins ECL logic- level-compatible (10K, 100K, or 101K), or with up to half the pins compatible with TTL levels, thereby eliminating the need for external ECL/TTL translators. Further, the unique OCEAN OF CELLS™ logic structure allows for on-chip implementation of simple analog functions.

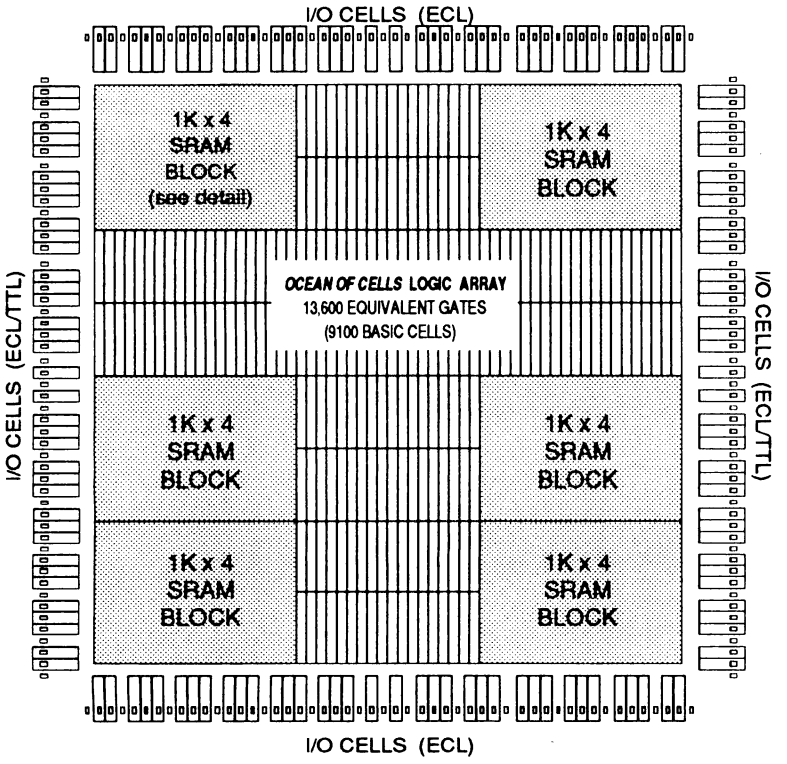
With system clock frequencies above 1GHz, the Synergy System Element (SSE) family is ideally suited for such demanding high-speed applications as mainframe and supermini computers, graphic workstations and servers, automatic test equipment, optical communications, and many military systems.

Supported by Synergy's Design And Verification Environment (DAVE™), an advanced system of integrated design tools, these products offer the designer much higher levels of high-performance system integration and design productivity.

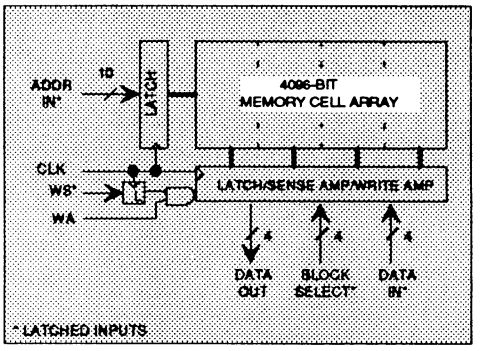
FEATURES

- 3ns on-board SRAM; 24K bits total; Alpha particle immune
- Highest-density logic via unique 6-transistor cell:
  - + greatest functionality per unit area
  - + shortest propagation delays
- CAD-Programmable speed/power options
- Available in Ultra-High-Performance molded packages (PGA &SMT) with embedded heat slug & optional heat sink
- I/O & Vee compatible with 10K, 100K or 101K ECL logic
- Direct interface with TTL busses and control signals
- Analog capabilities in Synergy's proprietary "Analog Zone"
- Built with advanced ASSET I technology
- 70 ps typical internal gate delay
- Fully compatible with Universal System Elements (USE™)
- Higher engineering productivity with DAVE CAE system

BLOCK DIAGRAM


I/O CELLS (ECL)
1K x 4 SRAM BLOCK (see detail)
1K x 4 SRAM BLOCK
OCEAN OF CELLS LOGIC ARRAY
13,600 EQUIVALENT GATES
(9100 BASIC CELLS)
1K x 4 SRAM BLOCK
1K x 4 SRAM BLOCK
1K x 4 SRAM BLOCK
1K x 4 SRAM BLOCK
I/O CELLS (ECL/TTL)
I/O CELLS (ECL/TTL)
I/O CELLS (ECL)

DETAIL
1K x 4 SRAM BLOCK



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Synergy Semiconductor

SYNERGY SEMICONDUCTOR

UNIVERSAL SYSTEM ELEMENT (USE™)

Preliminary
SY21BP00
Preliminary

DESCRIPTION

The SY21BP00 Universal System Element is a member of Synergy's new System Element family. Fabricated in the ASSET™ I bipolar process , these high-performance VLSI components offer an unprecedented combination of circuit density, interface flexibility, and minimal propagation delay logic---while dissipating significantly less power than competing products.

The SY21BP00 features 31,680 equivalent 2-input gates of 70ps logic, and routinely achieves logic density in *excess* of 450 gates/square millimeter. The 144 I/O pins may be configured with all pins ECL logic- level-compatible (10K, 100K, or 101K), or with up to half the pins compatible with TTL levels, hereby eliminating the need for external ECL/TTL translators. Further, the unique OCEAN OF CELLS™ logic structure allows for on-chip implementation of simple analog functions.

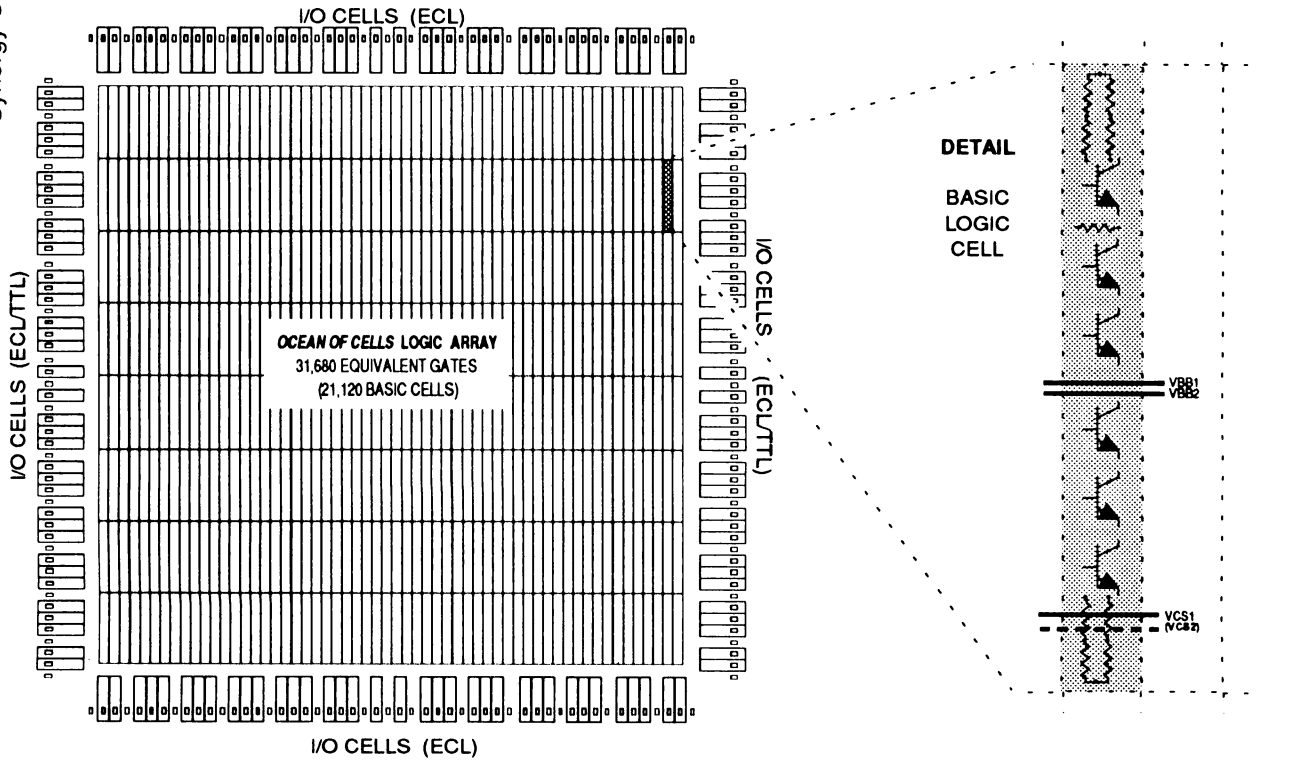
With system clock frequencies above 1GHz, the Synergy System Element (SSE) family is ideally suited for such demanding high-speed applications as mainframe and supermini computers, graphic workstations and servers, automatic test equipment, optical communications, and many military systems.

Supported by Synergy's Design And Verification Environment (DAVE ™), an advanced system of integrated design tools, these products offer the designer much higher levels of high-performance system integration and design productivity.

FEATURES

- Highest-density logic via unique 6-transistor cell:
  - + greatest functionality per unit area
  - + shortest propagation delays
- 21,120 logic cells yield 31,680 (gross) equivalent gates
- CAD-programmable speed/power options
- Available in Ultra-High-Performance molded packages (PGA &SMT) with embedded heat slug & optional heat sink
- I/O & Vee compatible with 10K, 100K or 101K ECL logic
- Direct interface with TTL busses and control signals
- Analog capabilities in Synergy's proprietary "Analog Zone"
- Built with advanced ASSET I technology
- 70 ps typical internal gate delay
- Compatible with RAM-Intensive System Elements (RISE™)
- Higher engineering productivity with DAVE CAE system

BLOCK DIAGRAM



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PRECISION OPERATIONAL AMPLIFIERS

Low-Power Chopper Stabilized

Device	Offset Voltage Initial (μV)	Offset Voltage Drift (μV/°C)	Input Current Bias (pA)	Input Current Offset (pA)	Output Range (V)	Output Range (mA)	AOL (dB)	Unity Gain BW (MHz)	Slew Rate (V/μs)	Supply Current (mA)	Package
TC900	±5	±0.05	±50	±1	±3.5	±0.35	120	0.7	±0.2	0.2	8-/14-Pin DIP
TC7650	±5	±0.05	±10	±0.5(t)	±4.7	±0.47	120	2	±2.5	2	8-/14-Pin DIP
TC7652	±5	±0.05	±30	±150	±4.7	±0.47	120	0.4	±1	1	8- or 14-Pin DIP
TC9420	±5	±0.1	±30	±60	±12	±1.2	120	0.5	±0.5	1.3	8-Pin DIP
TC9421	±5	±0.1	±30	±60	±12	±1.2	120	0.5	±0.5	1.3	16-Pin DIP
TC7650A	±5	±0.2	±15	±0.5(t)	±4.7	±0.47	120	1	±4	1.7	8-/14-Pin DIP
TC915	±10	±0.1	±100	±100	±13	±1.3	120	0.5	±0.5	1	8-/14-Pin DIP
TC901	±15	±0.15	±50	±100	±13	±1.3	120	0.8	±2	0.45	8-/14-Pin DIP
TC911	±15	±0.15	±70	±20	±4	±1.4	115	1.5	±2.5	0.35	8-Pin DIP
1701	±15	±0.25	±50	±1	±12	±5	112	1(t)	±1.2	5	Module G4
TC918	±50	±0.8	±100	—	±3.5	±0.14	100	0.7	±0.2	0.3	8- or 14-Pin DIP

Dual Low-Power Chopper Stabilized

Device	Offset Voltage Initial (μV)	Offset Voltage Drift (μV/°C)	Input Current Bias (pA)	Input Current Offset (pA)	Output Range (V)	Output Range (mA)	AOL (dB)	Unity Gain BW (MHz)	Slew Rate (V/μs)	Supply Current (mA)	Package
TC903*	±15	±0.15	±50	±100	±13	±1.3	120	0.8	±2	0.9	8-Pin DIP
TC913	±15	±0.15	±90	±20	±4	±1.4	115	1.5	±2.5	0.65	8-Pin DIP

* Advanced Product Information

Quad Low-Power Chopper Stabilized

Device	Offset Voltage Initial (μV)	Offset Voltage Drift (μV/°C)	Input Current Bias (pA)	Input Current Offset (pA)	Output Range (V)	Output Range (mA)	AOL (dB)	Unity Gain BW (MHz)	Slew Rate (V/μs)	Supply Current (mA)	Package
TC904*	±15	±0.15	±50	±100	±13	±1.3	120	0.8	±2	1.8	14-Pin DIP
TC914	±15	±0.15	±90	±20	±4	±1.4	115	1.5	±2.5	1.6	14-Pin DIP

* Advanced Product Information

Electrometer Grade

Device	Output Range @ Rated Load (V)	Output Range @ Rated Load (mA)	AOL (dB)	GBWP (MHz)	Unity Gain BW (MHz)	Settling Time (μs-0.1%)	Slew Rate (V/μs)	Offset Voltage Initial (mV)	Offset Voltage Drift (μV/°C)	Bias Current Initial (nA)	Bias Current Drift (nA/°C)	Package
1702	±10	±5	100	—	500 Hz	—	±50 μV	±5	±30	±5fA	±2fA	Module G4

POWER DRIVER IC GUIDE

These power drivers are made in CMOS to interface between low-level control functions (like TTL) and high-power switching devices, such as power MOSFETs. The drivers are an optimum choice for capacitive, inductive or resistive power driver applications. Many input options are available to make it easy to interface these TC drivers to any load.

CMOS power drivers feature high efficiency and the ability to swing the output rail-to-rail for enhanced power system performance. All TC power drivers also feature EPI construction for latch-up protection and ESD protection of 2 kV on each pin.

Proprietary Tough CMOS™ construction is featured on a wide range of TC power drivers to make these devices more reliable and easier to use. Tough CMOS™ protects the input from ground spikes and below ground ringing to –5 VDC, in addition to output latch-up and ESD protection. Special plastic molding compound is used to protect from environmental damage and increase reliability.

Designed for maximum-load monitoring, this device family will shut itself off based on some user-selected parameter - and stay off until the next control cycle. The TC4460 will interface directly to power devices in Motorola's SenseFET® which feeds back a voltage proportional to drain current. The TC4460 has a 6A drive capability and a shut-down response of 200ns.

MOSFET, CCD and Power Drivers

Device	Drivers Per Package	Peak Drive I (A)[1]	Outputs INV	Outputs NI	Test Load (pF)	Rise Time[1] (ns)	Fall Time[1] (ns)	Propagation Delay Low to High	Propagation Delay High to Low	Tough CMOS™	Surface Mount Package	Recommended With
TC1426	2	1.2	■		1000	30	20	55	80		8	Hex 0-3
TC1427	2	1.2		■	1000	30	20	55	80		8	Hex 0-3
TC1428	2	1.2	■	■	1000	30	20	55	80		8	Hex 0-3
TC4467	4	1.2			470	20	20	55	45	Y	16W	Hex 0-3
TC4468	4	1.2			470	20	20	55	45	Y	16W	Hex 0-3
TC4469	4	1.2			470	20	20	55	45	Y	16W	Hex 0-3
TC426	2	1.5	■		1000	30	20	40	75		8	Hex 0-3
TC427	2	1.5		■	1000	30	20	40	75		8	Hex 0-3
TC428	2	1.5	■	■	1000	30	20	40	75		8	Hex 0-3
TC4426	2	1.5	■		1000	25	25	30	45	Y	8	Hex 0-3
TC4427	2	1.5		■	1000	25	25	30	45	Y	8	Hex 0-3
TC4428	2	1.5	■	■	1000	25	25	30	45	Y	8	Hex 0-3
TC4423	2	3	■		2200	30	30	30	35	Y	16W	Hex 4
TC4424	2	3		■	2200	30	30	30	35	Y	16W	Hex 4
TC4425	2	3	■	■	2200	30	30	30	35	Y	16W	Hex 4
TC429	1	6	■		10,000	70	80	55	60		—	Hex 5-7
TC4420	1	6		■	4700	50	40	40	50	Y	8	Hex 5-7
TC4429	1	6	■		4700	50	40	40	50	Y	8	Hex 5-7
TC4421*	1	9	■		10,000	75	75	60	60	Y	—	Hex 5-7
TC4422*	1	9		■	10,000	75	75	60	60	Y	—	Hex 5-7
TC430	2	3	C	C	2000	25	25	15	15			NA

NOTES: 1. At test load.

C = Complimentary Outputs

* Advanced Product Information

Remote Shut-Down, Power MOSFET Drivers

Device	Drivers Per Package	Peak Drive I (A)[1]	Outputs INV	Outputs NI	Test Load (pF)	Rise Time[1] (ns)	Fall Time[1] (ns)	Propagation Delay Low to High	Propagation Delay High to Low	Computer Threshold	Computer Delay to Output	Reset Input Polarity
TC460	1	6		■	2500	25	25	75	75	100±10mV	200nS	Low
TC4461	1	6	■		2500	25	25	75	75	100±10mV	200nS	High
TC4462	1	6		■	2500	25	25	75	75	100±10mV	200nS	Low
TC4463	1	6	■		2500	25	25	75	75	100±10mV	200nS	High

Teledyne

TELEDYNE COMPONENTS

POWER DRIVER IC GUIDE (Cont.)

Other Drivers

These drivers feature output structures other than totem pole and bring the advantages of Teledyne's latch-proof Tough CMOS™ to applications such as interfacing LEDs, relays, and other peripheral devices to control logic. Tough CMOS™.

Dual MOSFET, Motor and Power Drivers — Open Drain Outputs

Device	Peak Drive I (A)	Outputs INV	Outputs NI	Test Load (pF)	Rise Time (ns)	Fall Time (ns)	Propagation Delay Low to High	Propagation Delay High to Low	Output
TC4403*	3A	■	■	1800	35	35	75	75	Note 1
TC4404*	1.5A	■		1000	25	25	30	45	Separate Sink & Source
TC4405*	1.5A		■	1000	25	25	30	45	Separate Sink & Source
TC4406*	3A	■		1800	35	35	75	75	Separate Sink & Source
TC4407*	3A		■	1800	35	35	75	75	Separate Sink & Source
TC4401*	6A	■		2500	35	35	75	75	

NOTES: 1. Squib firing (safety interlock) driver.

* Advanced Product Information

Quad MOSFET, Motor and Power Drivers — Open Drain Outputs

Device	Peak Drive I (A)	Input Logic	Test Load (pF)	Rise Time (ns)	Fall Time (ns)	Propagation Delay Low to High	Propagation Delay High to Low	Output (Open Drain)
TC4437	1.2	NAND	470	—	20	55	45	Sink
TC4438	1.2	AND	470	—	20	55	45	Sink
TC4439	1.2	AND/NAND	470	—	20	55	45	Sink
TC4457	1.2	NAND	470	—	20	55	45	Sink w/Clamp Diode
TC4458	1.2	AND	470	—	20	55	45	Sink w/Clamp Diode
TC4459	1.2	AND/NAND	470	—	20	55	45	Sink w/Clamp Diode
TC4487	1.2	NAND	470	20	—	55	45	Source
TC4488	1.2	AND	470	20	—	55	45	Source
TC4489	1.2	AND/NAND	470	20	—	55	45	Source

SOLID-STATE THERMAL SENSORS

TC620/TC621

The TC620 and TC621 are solid-state temperature switches designed to replace mechanical switches in temperature-sensing applications. High and Low Set Point limits can be programmed with external resistors. Three independent outputs indicate Low limit, High limit, and 'In-Range' conditions.

Device	Temperature Sensor	Absolute Accuracy (°C)	Output Current (mA)	Supply Voltage (V)	Supply Current (µA) Max	Package
TC620*	On-Chip	±3	1	4.5-18	200	8-Pin DIP, SOIC
TC621*	External Thermistor	±3	10	4.5-18	200	8-Pin DIP, SOIC

* Advanced Product Information

TC626

The TC626 is a solid-state thermal switch which is designed to replace mechanical switches in temperature-sensing applications. The TC626 output will switch to the high state when the internally programmed temperature limit is exceeded. Temperature limits are available in 5°C increments, from 0°C to +125°C.

Device	Absolute Accuracy (°C)	Hysteresis (°C)	Output Current (mA)	Supply Voltage (V)	Supply Current (µA) Max	Package
TC626*	±3	10	50	4.5-18	600	TO-92, TO-220

* Advanced Product Information

Teledyne

BATTERY CHARGER CONTROL

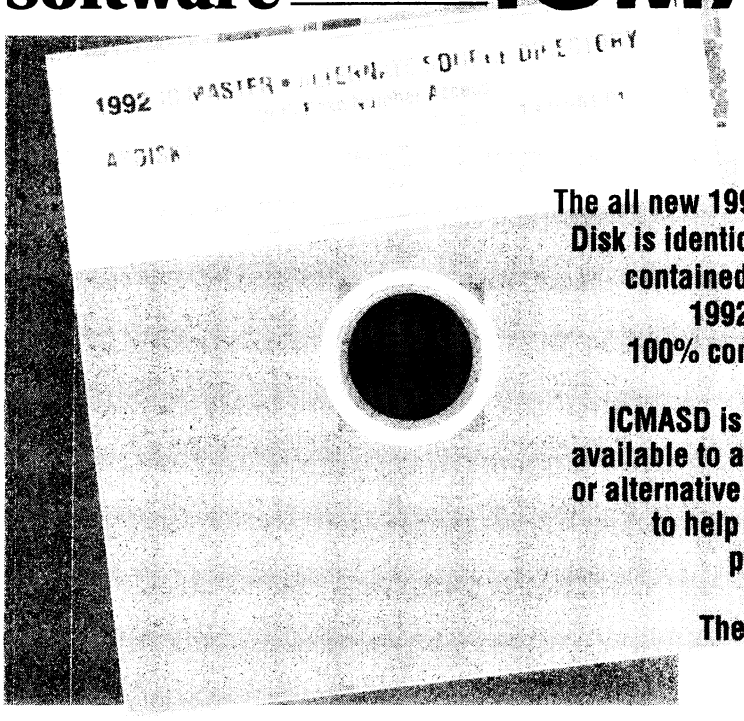
TC675/TC676

The TC675 and TC676 are battery charger control ICs designed for fast charging of from two to ten NiCad batteries. Battery charge status is monitored by an external thermistor, with an on-chip 1 1/2 hour maximum charge timer for added protection. An external SCR controls switching current, and an LED indicates the fast-charge mode. After completion of the fast-charge cycle, the charger automatically switches to trickle-charge mode.

Device	Supply Voltage (V Min)	SCR Drive Current (mA)	Fast-Charge Time (Hr Max)	Reset Option	Package
TC675	4.5	10	1 1/2	Trickle-Charge	14-Pin DIP, 16-PinSO
TC676	4.5	10	1 1/2	Fast-Charge	14-Pin DIP, 16-PinSO

Hearst Engineering Software

ICMASD *Alternate Source Directory*



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Toshiba.
World Leader in Dynamic RAM.

Preliminary

262, 144 Word x 4 Bit Multiport DRAM
Silicon Gate CMOS

TC524258BJ/BZ-10
TC524258BJ/BZ-12

The TC524258BJ/BZ is a CMOS multiport memory equipped with a 262,144-words by 4-bits dynamic random access memory (RAM) port and a 512-words by 4-bits static serial access memory (SAM) port. The TC524258BJ/BZ supports three types of operations: Random access to and from the RAM port, high speed serial access to and from the SAM port and bidirectional transfer of data between any selected row in the RAM port and the SAM port. The RAM port and the SAM port can be accessed independently except when the data is being transferred between them internally. In addition to the conventional multiport videoram operating modes, the TC524258BJ/BZ features the block write and flash write functions on the RAM port and a split register data transfer capability on the SAM port. The TC524258BJ/BZ is fabricated using Toshiba's CMOS silicon gate process as well as advanced circuit designs to provide low power dissipation and wide operating margins.

FEATURES

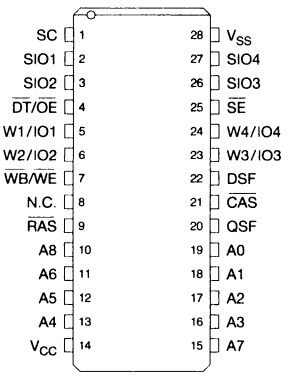
ITEM		TC524258BJ/BZ	
		-80	-10
t_{RAC}	$\overline{RAS}$ Access Time (Max.)	80ns	100ns
t_{CAC}	$\overline{CAS}$ Access Time (Max.)	25ns	25ns
t_{AA}	Column Address Access Time (Max.)	45ns	50ns
t_{RC}	Cycle Time (Min.)	150ns	180ns
t_{PC}	Page Mode Cycle Time (Min.)	50ns	55ns
t_{SCA}	Serial Access Time (Max.)	25ns	25ns
t_{SCC}	Serial Cycle Time (Min.)	30ns	30ns
I_{CC1}	RAM Operating Current (SAM : Standby)	85mA	70mA
I_{CC2A}	SAM Operating Current (RAM : Standby)	50mA	50mA
I_{CC2}	Standby Current	10mA	10mA

- **Organization**
  RAM Port: 262,144 words x 4 bits
  SAM Port: 512 words x 4 bits
- **RAM Port**
  Fast Page Mode, Read - Modify - Write
  $\overline{CAS}$ before $\overline{RAS}$ Refresh, Hidden Refresh
  $\overline{RAS}$ only Refresh, Write per Bit
  Flash Write, Block Write
  512 refresh cycles/8ms
- **SAM Port**
  High Speed Serial Read/Write Capability
  512 Tap Locations
  Fully Static Register
- **RAM-SAM Bidirectional Transfer**
  Read/Write/Pseudo Write Transfer
  Real Time Read Transfer
  Split Read/Write Transfer
- **Package**
  TC524258BJ: SOJ28-P-400
  TC524258BZ: ZIP28-P-400
- **Single power supply of 5V±10% with built-in V_{BB} generator**
- **All inputs and outputs: TTL Compatible**

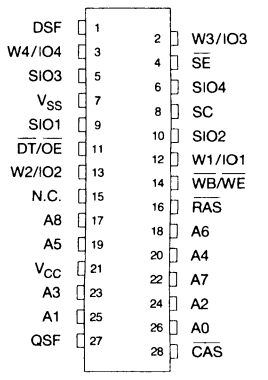
PIN NAMES

A0~A8	Address Inputs
$\overline{RAS}$	Row Address Strobe
$\overline{CAS}$	Column Address Strobe
$\overline{DT}/\overline{OE}$	Data Transfer/Output Enable
$\overline{WB}/\overline{WE}$	Write Per Bit/Write Enable
DSF	Special Function Control
W1/IO1~W4/IO4	Write Mask/Data IN, OUT
SC	Serial Clock
$\overline{SE}$	Serial Enable
SIO1~SIO4	Serial Input/Output
QSF	Special Flag Output
V_{CC}/V_{SS}	Power (5V)/Ground
N.C.	No Connection

PIN CONNECTION



TC524258BJ
28 Pin 400mil SOJ
JEDEC Standard



TC524258BZ
28 Pin 400mil height ZIP
JEDEC Standard

TOSHIBA AMERICA ELECTRONIC COMPONENTS, INC.

Toshiba America

524,288 Word x 9 Bit Dynamic RAM
Silicon Gate CMOS

TC514900AJLL/AZLL-70
TC514900AJLL/AZLL-80
TC514900AJLL/AZLL-10

The TC514900AJLL/AZLL is the new generation dynamic RAM organized 524,288 words by 9 bits. The TC514900AJLL/ZALL utilizes Toshiba's CMOS Silicon gate process technology as well as advanced circuit techniques to provide wide operating margins, both internally and to the system user. Multiplexed address inputs permit the TC514900AJLL/AZLL to be packaged in a standard 28 pin plastic SOJ and 28 pin plastic ZIP. The package size provides high system bit densities and is compatible with widely available automated testing and insertion equipment. System oriented features include single power supply of 5V ± 10% tolerance, direct interfacing capability with high performance logic families such as Schottky TTL.

FEATURES

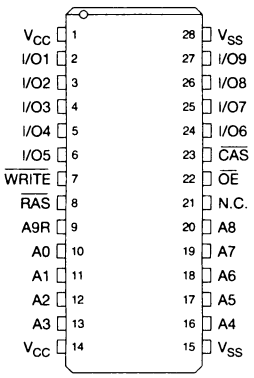
ITEM		TC514900AJLL/AZLL-70/-80/-10		
		-70	-80	-10
t_{RAC}	$\overline{RAS}$ Access Time	70ns	80ns	100ns
t_{AA}	Column Address Access Time	35ns	40ns	50ns
t_{CAC}	$\overline{CAS}$ Access Time	20ns	20ns	25ns
t_{RC}	Cycle Time	130ns	150ns	180ns
t_{PC}	Fast Page Mode Cycle Time	45ns	50ns	60ns

- 524,288 word by 9 bit organization
- Fast access time and cycle time
- Single power supply of 5V±10% with built-in V_{BB} generator
- Low Power
  633mW Max. Operating (TC514900AJLL/AZLL-70)
  550mW Max. Operating (TC514900AJLL/AZLL-80)
  495mW Max. Operating (TC514900AJLL/AZLL-10)
  1.1mW Max. Standby
- Outputs unlatched at cycle end allows two-dimensional chip selection
- Read-Modify-Write, $\overline{CAS}$ before $\overline{RAS}$ refresh, $\overline{RAS}$-only refresh, Hidden refresh, Self refresh and Fast Page Mode Capability
- All inputs and outputs: TTL Compatible
- 1024 refresh cycles/128ms
- Package
  TC514900AJLL: SOJ28-P-400
  TC514900AZLL: ZIP28-P-400

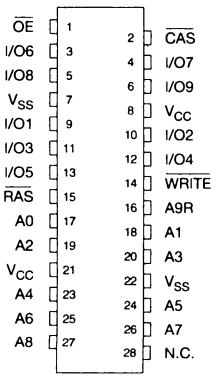
PIN NAMES

A0~A8, A9R	Address Inputs
$\overline{RAS}$	Row Address Strobe
$\overline{CAS}$	Column Address Strobe
$\overline{WRITE}$	Read/Write Input
$\overline{OE}$	Output Enable
I/O1~I/O9	Data Input/Output
V_{CC}	Power (+5V)
V_{SS}	Ground
N.C.	No Connection

PIN CONNECTION



TC514900AJLL
28 Pin 400mil SOJ
JEDEC Standard



TC514900AZLL
28 Pin 475mil height ZIP
JEDEC Standard

Toshiba America

TOSHIBA AMERICA ELECTRONIC COMPONENTS, INC.

16,777,216 Word x 1 Bit Dynamic RAM
Silicon Gate CMOS

TC5116100J/Z-60
TC5116100J/Z-70
TC5116100J/Z-80

The TC5116100J/Z is the new generation dynamic RAM organized 16,777,216 words by 1 bit. The TC5116100J/Z utilizes Toshiba's new CMOS Silicon gate process technology as well as advanced circuit techniques to provide wide operating margins, both internally and to the system user. Multiplexed address inputs permit the TC5116100J/Z to be packaged in a standard 28/24 pin plastic SOJ (400mil) and 24 pin plastic ZIP. The package size provides high system bit densities and is compatible with widely available automated testing and insertion equipment. System oriented features include single power supply of 5V ± 10% tolerance, direct interfacing capability with high performance logic families such as Schottky TTL.

FEATURES

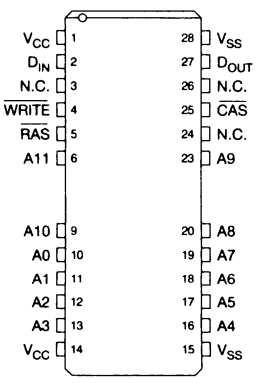
ITEM		TC5116100J/Z-60/-70/-80		
		-70	-80	-10
t_{RAC}	$\overline{RAS}$ Access Time	60ns	70ns	80ns
t_{AA}	Column Address Access Time	30ns	35ns	40ns
t_{CAC}	$\overline{CAS}$ Access Time	15ns	20ns	20ns
t_{RC}	Cycle Time	110ns	130ns	150ns
t_{PC}	Fast Page Mode Cycle Time	40ns	45ns	50ns

- 16,777,216 word by 1 bit organization
- Fast access time and cycle time
- Single power supply of 5V±10% with built-in V_{BB} generator
- Low Power
  495mW Max. Operating (TC5116100J/Z-60)
  440mW Max. Operating (TC5116100J/Z-70)
  385mW Max. Operating (TC5116100J/Z-80)
  5.5mW Max. Standby
- Outputs unlatched at cycle end allows two-dimensional chip selection
- Common I/O capability using "EARLY WRITE" operation
- Read-Modify-Write, $\overline{CAS}$ before $\overline{RAS}$ refresh, $\overline{RAS}$-only refresh, Hidden refresh, Fast Page Mode and Test Mode Capability
- All inputs and outputs: TTL Compatible
- 4096 refresh cycles/64ms
- Package
  TC5116100J: SOJ28-P-400
  TC5116100Z: ZIP24-P-475

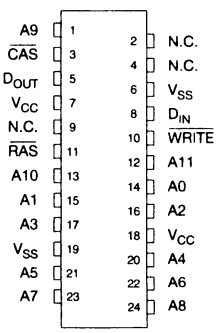
PIN NAMES

A0~A11	Address Inputs
$\overline{RAS}$	Row Address Strobe
D_{IN}	Data In
D_{OUT}	Data Out
$\overline{CAS}$	Column Address Strobe
$\overline{WRITE}$	Read/Write Input
V_{CC}	Power (+5V)
V_{SS}	Ground
N.C.	No Connection

PIN CONNECTION

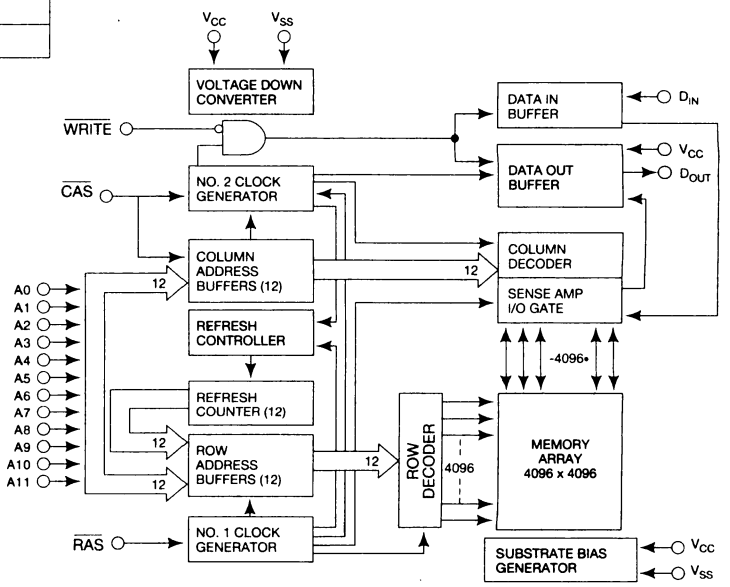


TC5116100J
28 Pin 400mil SOJ
JEDEC Standard



TC5116100Z
24 Pin 475mil height ZIP
JEDEC Standard

BLOCK DIAGRAM



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Toshiba.
World Leader in Pseudo SRAMs.

Preliminary

524,288 Words x 8 Bit CMOS Pseudo Static RAM
Silicon Gate CMOS

TC518512PL/FL/FTL/TRL-70, -80, -10

The TC518512PL Family is a 4M bit high speed CMOS Pseudo Static RAM organized as 524,288 words by 8 bits. The TC518512PL Family utilizing one transistor dynamic memory cell with CMOS peripheral circuit provides large capacity, high speed and low power features. The feature includes single power supply of 5V±10%. The $\overline{OE}$/$\overline{RFSH}$ input allows two types of refresh operation– auto refresh and self refresh.

The TC518512PL Family also features static RAM-like write function in which the input data is written into the memory cell at the rising edge of R/W, thus easier to interface with the microprocessor.

The TC518512PL Family is molded in a 32 pin standard 0.6 inch width plastic DIP, Small Outline Plastic Flat Package and Thin Small Outline Package.

FEATURES

ITEM	TC518512PL Family		
	-70	-80	-10
t_{CEA} $\overline{CE}$ Access Time	70ns	80ns	100ns
t_{OEA} $\overline{OE}$ Access Time	30ns	30ns	40ns
t_{RC} Cycle Time	115ns	130ns	160ns
Power Dissipation	385mW	330mW	275mW
Self Refresh Current	200μA		

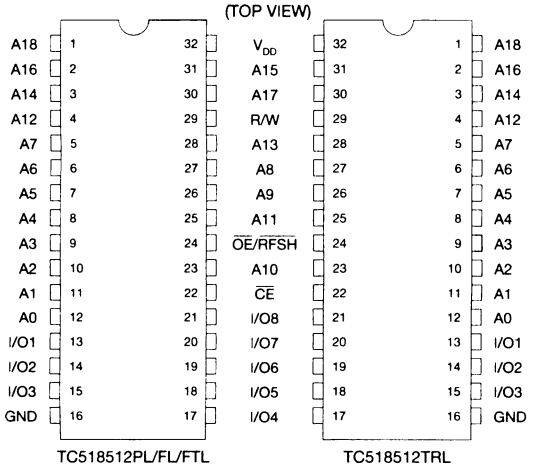
- Organization: 4M bit (524,288 word x 8 bit)
- Fast access time and low power dissipation
- Single power supply: 5V±10%
- Auto refresh is capable by internal counter
- Self refresh is capable by internal timer
- All inputs and outputs: TTL compatible
- 2048 refresh cycle/32ms
- Logic Compatible: SRAM R/W Pin
- Package
  TC518512PL: DIP32-P-600
  TC518512FL: SOP32-P-525
  TC518512FTL: TSOP32-P-400
  TC518512TRL: TSOP32-P-400A

PIN NAMES

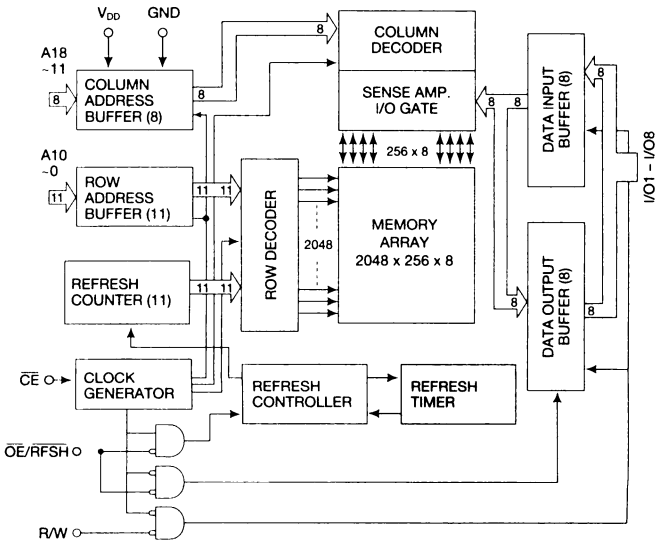
A0~A18	Address Inputs
R/W	Read/Write Control Input
$\overline{OE}$/$\overline{RFSH}$	Output Enable Input/Refresh Input
$\overline{CE}$	Chip Enable Inputs
I/O1~I/O8	Data Inputs/Outputs
V_{DD}	Power
GND	Ground

PIN CONNECTION

(TOP VIEW)



BLOCK DIAGRAM



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Toshiba.
World Leader in High Speed SRAMs.

Preliminary

65,536 Word x 16 Bit CMOS Static RAM
Silicon Gate CMOS

TC551664J-15
TC551664J-20
TC551664J-25

The TC551664J is a 1,048,576 bits high speed static random access memory organized as 65,536 words by 16 bits using CMOS technology, and operated from a single 5-volt supply. Toshiba's CMOS technology and advanced circuit form provide high speed features.

The TC551664J has low power features with device control using Chip Enable ($\overline{CE}$), and has Output Enable Input ($\overline{OE}$) for fast memory access. Also it allows lower and upper byte access by Data Byte Control ($\overline{LB}$, $\overline{UB}$). The TC551664J is suitable for use in various application systems where high speed is required as cache memory, high speed storage, and so on. All Inputs and Outputs are directly TTL compatible.

The TC551664J is molded in 44 pin plastic SOJ with 400 mil width for high density surface assembly.

PIN NAMES

A0~A15	Address Inputs
I/O1~I/O16	Data Inputs/Outputs
$\overline{CE}$	Chip Enable Input
$\overline{WE}$	Write Enable Input
$\overline{OE}$	Output Enable Input
$\overline{LB}$, $\overline{UB}$	Data Byte Control Input
V_{DD}	Power (+5V)
GND	Ground
N.C.	No Connection

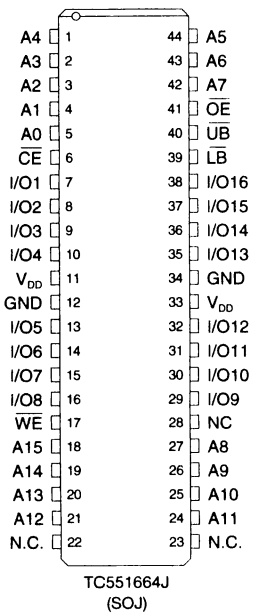
FEATURES

- Fast access time:
  TC551664J-15: 15ns (MAX.)
  TC551664J-20: 20ns (MAX.)
  TC551664J-25: 25ns (MAX.)
- 5V single power supply: 5V±10%
- Fully Static Operation
- Low power dissipation
- All Inputs and Outputs: TTL compatible
- Output buffer control: $\overline{OE}$
- Data byte control
  $\overline{LB}$ (I/O1~I/O8), UB (I/O9~I/O16)
- Package: SOJ44-P-400

Cycle Time	15	20	25	30	50	ns
Operation (MAX.)	260	220	200	180	150	mA

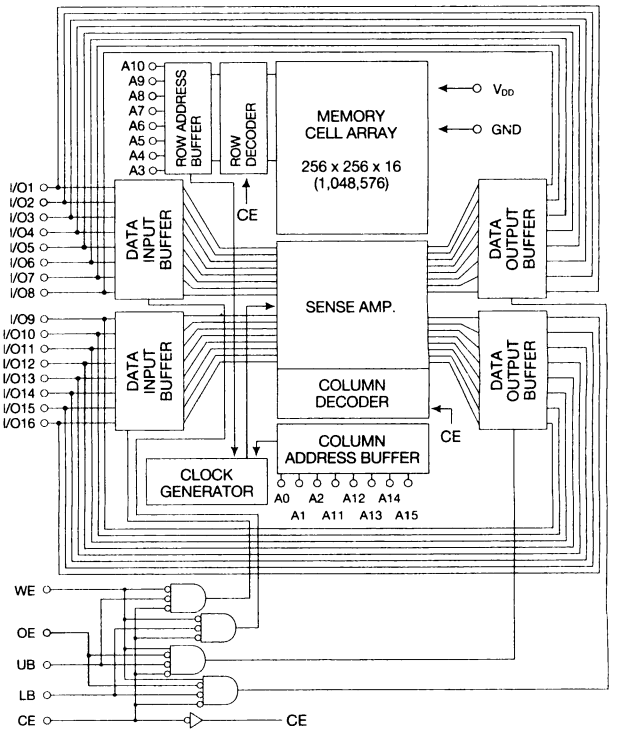
Standby: 1mA (MAX.)

PIN CONNECTION



TC551664J
(SOJ)

BLOCK DIAGRAM



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Preliminary

32,768 Word x 8 Bit BiCMOS Static RAM	**TC55B328P/J**
32,768 Word x 9 Bit BiCMOS Static RAM	**TC55B329P/J**
65,536 Word x 4 Bit BiCMOS Static RAM	**TC55B464P/J**
Silicon Gate BiCMOS	**TC55B465P/J**

The TC55B328P/J and TC55B464/5/P/J are 262,144 bit high speed static random access memories organized as 32,768 words by 8 bits and 65,536 words by 4 bits, respectively. The TC55B329P/J is a 294,912 bit high speed static random access memory organized as 32,768 words by 9 bits. All use BiCMOS technology and are operated from a single 5-volt supply. Toshiba's BiCMOS technology and advanced circuit design provide high speed function. The TC55B328P/J, TC55B465P/J and the TC55B464P/J have a low power feature with device control using Chip Enable ($\overline{CE}$), and the TC55B465, TC55B328 and TC55B329 have Output Enable Input ($\overline{OE}$) for fast memory access. The TC55B329P/J has a low power feature with device control using Chip Enable ($\overline{CE}$1/CE2). All four configurations have an automatic power down feature. These devices are suitable for cache memory and high speed storage where high speed is required. All Inputs and Outputs are directly TTL compatible. The TC55B328P/J and TC55B465P/J are molded in 28 pin DIP and SOJ. The TC55B329P/J is molded in 32 pin DIP and SOJ. The TC55B464P/J is molded in 24 pin DIP and SOJ. All packages are 300 mil width for high density surface assembly and are JEDEC standard.

FEATURES

- **Fast access time**

TC55B328/9	TC55B464/5	P/J-10	10ns (max.)
TC55B328/9	TC55B464/5	P/J-12	12ns (max.)
TC55B328/9	TC55B464/5	P/J-15	15ns (max.)

- **Low power dissipation**

Operation:

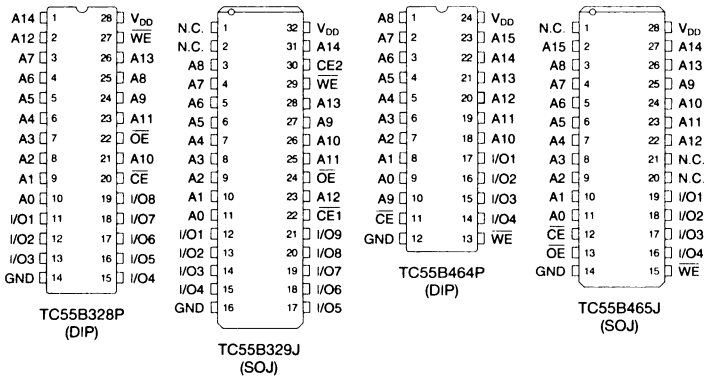
TC55B328P/J	10/12/15	170mA (max.)
TC55B329P/J	10/12/15	170mA (max.)
TC55B464P/J	10/12/15	140mA (max.)
TC55B465P/J	10/12/15	140mA (max.)

Standby: 10mA (max.)

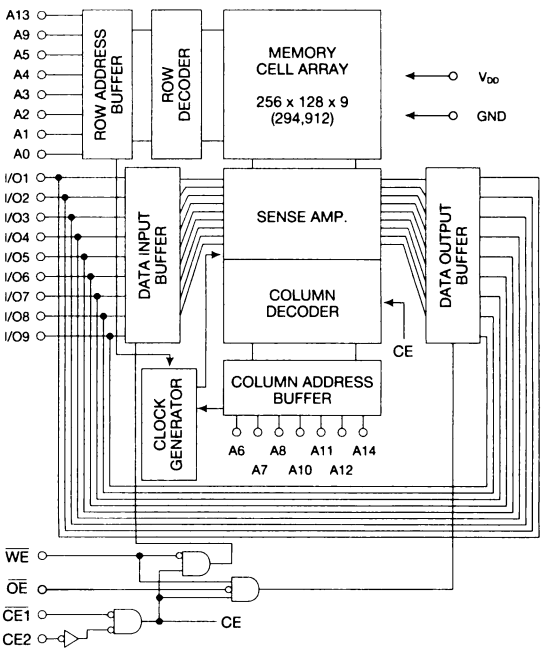
- **5V single power supply: 5 ± 10%**
- **Fully static operation**
- **All Inputs and Outputs: TTL compatible**
- **Output buffer control: OE**
- **Packages**

28 pin plastic 300 mil DIP: TC55B328P
28 pin plastic 300 mil SOJ: TC55B328J
32 pin plastic 300 mil DIP: TC55B329P
32 pin plastic 300 mil SOJ: TC55B329J
24 pin plastic 300 mil DIP: TC55B464P
24 pin plastic 300 mil SOJ: TC55B464J
28 pin plastic 300 mil DIP: TC55B465P
28 pin plastic 300 mil SOJ: TC55B465J

PIN CONNECTION



BLOCK DIAGRAM (TC55B329)



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Toshiba EPROM.
Balancing Technology and Performance.

Preliminary

1M Word x 16 Bit/2M Word x 8 Bit
CMOS U.V. Erasable and Electrically
Programmable Read Only Memory
Silicon Stacked Gate MOS

TC5716200D-150
TC5716200D-200

The TC5716200D is a 16,777,216 bit CMOS ultraviolet light erasable and electrically programmable read only memory. It is organized as 1M words by 16 bits or 2M words by 8 bits. The TC5716200D is compatible with 42 pin 16M bit Mask ROM. This product is packed in 42 pin standard cerdip package. The TC5716200D is fabricated with the CMOS technology. Advanced circuit techniques provide both high speed and low power features with access time of *150ns/200ns* and a maximum operating current of 60mA/6.7 MHz. The programming time of the TC5716200D, except overhead times of EPROM programmer, is only 52 seconds by using the high speed programming algorithm.

PIN NAMES

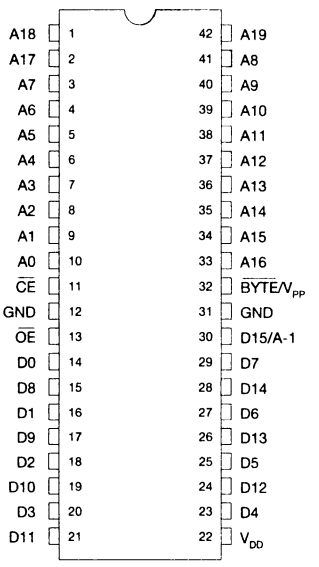
A0~A19	Address Input
D0~D14	Output (Input)
$\overline{CE}$	Chip Enable Input
$\overline{OE}$	Output Enable Input
D15/A-1	Output (Input)/Address Input
$\overline{BYTE}/V_{PP}$	Word, Byte select input/Program Supply Voltage
V_{CC}	V_{CC} Supply Voltage
V_{SS}	Ground

FEATURES

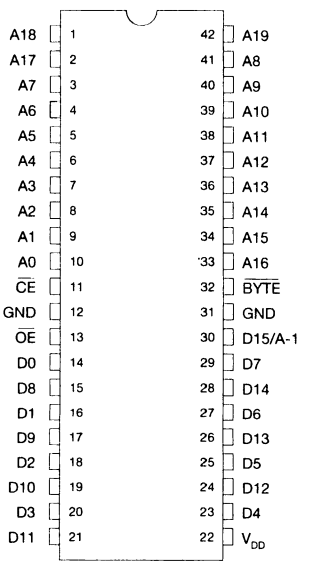
- ➤ Peripheral Circuit: CMOS Memory Cell: NMOS
- ➤ Fast Access Time (V_{CC}=5V±10%, Ta=0~70°C) TC5716200D-150: 150ns TC5716200D-200: 200ns
- ➤ Single 5V Power Supply
- ➤ Low Power Dissipation
- ➤ Standby: 100μA
- ➤ Fully Static Operation
- ➤ All Inputs and Outputs: TTL compatible
- ➤ Three State Outputs
- ➤ High Speed Programming Operation: t_{PW} 25μS
- ➤ 16M MROM Compatible Pinout: TC5316200P
- ➤ Standard 42 pin DIP cerdip Package: WDIP-42-G-600B

PIN CONNECTION

(TOP VIEW)



TC5716200D



16M Mask ROM
TC5316200P
(Reference)

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Toshiba Mask ROM. Economy at the Leading Edge.

Preliminary

1M Word x 16 Bit/2M Word x 8 Bit
CMOS Mask Read Only Memory
Silicon Gate CMOS

TC5316200AP/AF/AFT/ATR-150

The TC5316200AP/AF/AFT/ATR is a 16,777,216 bits read only memory organized as 1,048,576 words by 16 bits when $\overline{BYTE}$ is logical high, and is organized as 2,097,152 words by 8 bits when $\overline{BYTE}$ is logical low.

The TC5316200AP/AF/AFT/ATR is most suitable for the program memory, data memory and character generator.

The TC5316200AP is packaged in a standard 600mil 42 pin DIP, the TC5316200AF in a standard 600mil 44 pin SOP, and the TC5316200AFT/ATR in a 400mil 44 pin TSOP Type II.

Since the TC5316200ATR is the reverse type of the TC5316200AFT for the direction of the lead bend, it is easy to arrange the packages on a printed circuit board.

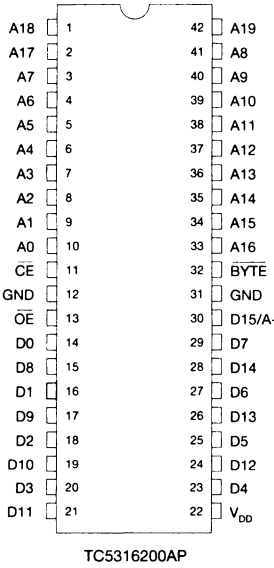
PIN NAMES

A0~A19	Address Input
D0~D14	Output (Input)
$\overline{CE}$	Chip Enable Input
$\overline{OE}$	Output Enable Input
D15/A-1	Output (Input)/Address Input
$\overline{BYTE}$	Word, Byte Selection Input
V_{DD}	Power Supply
V_{SS}	Ground
N.C.	No Connection

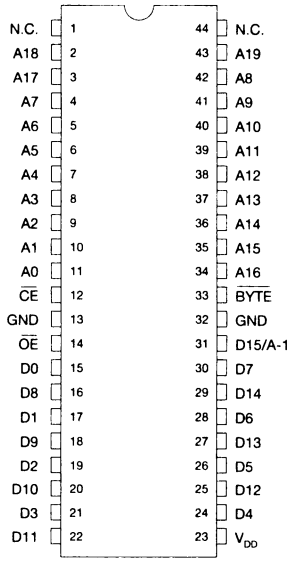
FEATURES

- ➤ Single 5V Power Supply
- ➤ Access Time: 150ns (Max.)
- ➤ Power Dissipation
  Operating Current: 600mA (Max.)
  Standby Current: 100μA (Max.)
- ➤ Fully Static Operation
- ➤ All Inputs and Outputs: TTL Compatible
- ➤ Three State Outputs
- ➤ TC5316200AP: DIP42-P-600
- ➤ TC5316200AF: SOP44-P-600
- ➤ TC5316200AFT: TSOP44-P-400
- ➤ TC5316200ATR: TSOP44-P-400A

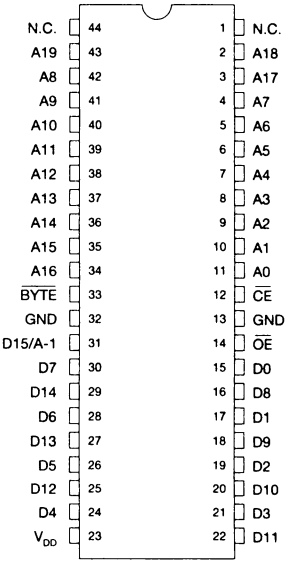
PIN CONNECTION (TOP VIEW)



TC5316200AP



TC5316200AF/AFT
(Normal lead bend)



TC5316200ATR
(Reverse lead bend)

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Toshiba offers the most comprehensive CMOS LOGIC line available– from our standard 4000 series up to our Advanced High Speed 74AC series. The Advanced High Speed series has typical prop delay times of 3.5ns and maximum clock frequencies of 150 megahertz. That's 33% faster than the original 74HC series. With high noise margin, high speed and low power consumption, these devices create opportunities for designers of high speed portable instruments, telecommunicators or any digital system. Now, Toshiba offers two lines of BiCMOS Logic. Available currently is a full line of Bus Interface Devices as well as several gate functions.

TOSHIBA HIGH SPEED (HC), ADVANCED HIGH SPEED (AC) CMOS AND BiCMOS (BC and ABT) FUNCTION SELECTION GUIDE

FUNCTION			HIGH SPEED TC74HC	ADVANCED HIGH SPEED TC74AC	BICMOS	
					TD74ABT	TD74BC
GATE	NAND		00A, T00A, 03A, 10A, 20A, 30A, 132A, 133A	00,T00, 10, T20, T10		00
	NCR		02A, T02A, 27A, 4002A, 4007A, 4078A	02, T02		
	AND		08A, T08A, 09A, 11A, 21A	08, T08, 11		08
	OR		32A, T32A, 4072A, 4075A, 4078A	32, T32		32
	INVERTER		04A, U04A, T04A, 05A, 07A	04, T04, 05		
	SCHMITT TRIGGER		14A, 132A	14, T14		
	MULTIFUNCTION		51A, 86A, T86A, 266A, 386A, 7266A	86, T86		
BUFFER			4049A, 4050A, T7007A			
	3-STATE		125A, 126A, 240A, T204A, 241A, T241A, 244A, T244A, 365A, 366A, 367A, 368A, 540A, T540A, 541A, T541A, 7240A, 7241A, 7244A	125, 126, 240, T240, 241, T241, 244, T244, 367, 368, 540, T540, 541, T541	240, 241, 244 540, 541, 2240, 2241, 2244	230, 231, 240, 241, 244, 365, 366, 367, 368, 540, 541
	BIDIRECTIONAL		242A, 243A, 245A, T245A, 620A, 623A, 640A, T640A, 634A, T634A, 7640A, 7643A, 7645A	245, T245, 620, 623, 640, T640, 643, 646, T646, 648, T648	245, 543, 544, 620, 623, 640, 643	242, 243, 620, 623, 640, 643, 645
FLIP FLOP J-K TYPE			73A, 76A, 107A, 109A, 112A, 113A	109, T109, 112, T112		
	D TYPE		74A, T74A, 174A, T174A, 175A, 273A, T273A, 377A	74, T74, 174, T174, 175, T175, 273, T273, 377, T377		
		3-STATE	374A, T374A, 534A, T534A, 564A, T564A, 574A, T574A, 646A, 648A, T648A, 651A, T651A, 652A, T652A	374, T374, 534, T534, 564, T564, 574, T574, 646, T646, 648, T648, 821, T821, 823, T823, 825, T825	374, 534, 564, 574, 646, 648, 651, 652, 653, 654, 821, 822	374
LATCH			75A, 77A, 259A, 279A, 375A			
		3-STATE	373A, T373A, 533A, T533A, 563A, T563A, 573A, T573A	373, T373, 533, T533, 563, T563, 573, T573, 841, T841, 843, T843	373, 533,563, 573, 841, 842	373, 533, 563, 573
MULTIVIBRATOR			123A, 221A, 423A, 4538A			
DECODER			42A, 131A, 137A, T137A, 138A, T138A, 139A, T139A, 154A, 155A, 237A, 238A, 4028A, 4514A, 4515A	138, T138, 139, T139		
		7-SEGMENT	4511A, 453A			
ENCODER			147A, 148A			
REGISTER			164A T164A, 165A, 166A, 173A, 194A, 195A, 299A, 323A, 595A, 597A, 670A, 4094A, 40105A	164, T164, 166, 299, T299, 323, T323, 670		
COUNTER		BINARY	161A, 163A, 191A, 193A, 393A, 590A, 592A, 593A, 691A, 693A, 697A, 699A, 4520A	161, T161, 163, T163, 169, 191, 393		
		DECADE	160A, 162A, 190A, 192A, 390A, 690A, 692A, 696A, 698A, 4518A	160, 162, 390		
		DIVIDER	4017A, 4020A, 4022A, 4024A, 4040A, 4060A, 40102A, 40103A, 7292A, 7294A			
MULTIPLEXER		ANALOG	4016A, 4051A, 4052A, 4053A, 4066A, 4316A, 4351A, 4352A, 4353A			
		DIGITAL	151A, 153A, 157A, T157A, 158A, T158A, 251A, 253A, 257A, T257A, 258A, T258A, 298A, 352A, 353A, 354A, 356A	151, T151, 153, 157, T157, 158, T158, 251, T251, 253, 257, T257, 258, T258		
OTHER	COMPARATOR		85A, 688A, T688A	520, T520, 521, T521		
	ADDER		283A	283, T283		
	ALU		181A, 182A			
	PARITY TREE		280A	280, T280	280	

Toshiba America

TOSHIBA STANDARD FUNCTION SELECTION GUIDE

GATE BUFFERS	NAND		TC4011BP/BF, TC4011UBP, TC4012BP/BF, TC4023BP/BF, TC4068BP/BF, TC7400BP
	NOR		TC4000BP, TC4001BP/BF, TC4001UBP, TC4002BP/BF, TC4025BF/BP, TC4078BP/BF
	AND		TC4068BP/BF, TC4073BP/BF, TC4081BP/BF, TC4082BP
	OR		TC4071BP/BF, TC4072BP/BF, TC4075BP/BF, TC4078BP/BF
	INVERTER		TC4007UBP/UBF, TC4009UBP/BF, TC4049BP/BF, TC4069UBP/UBF, TC7404UBP
	BUFFERS		TC4009UBP, TC4010BP, TC4049BP/BF, TC4050BP/BF
		3-STATE	TC4502BP, TC5012BP/BF, TC5024BP, TC5025BP
		OPEN DRAIN	TC40107BP, TC5029BP, TC5064BP, TC5065BP, TC5066BP, TC5067BP
	MULTIFUNCTION		TC4019BP/BF, TC4030BP/BF, TC4077BP//BF, TC4085BP, TC4086BP, TC4501BP, TC4519BP, TC4530BP, TC4572BP/BF
	SCHMITT TRIGGER		TC4093BP/BF, TC4583BP, TC4584BP/BF
	LEVEL SHIFTER		TC4009UPB, TC4010BP, TC4049BP/BF, TC4050BP/BF, TC5020BP
FLIP FLOP			TC4013BP/BF, TC4027BP/BF, TC40174BP/BF, TC40175BP/BF, TC7476BP
LATCHES			TC4042BP/BF, TC4043BP, TC4044BP/BF, TC4099BP/BF, TC4508BP
MULTIVIBRATORS			TC4047BP, TC4528BP/BF, TC4538BP/BF
DECODERS			TC4028BP/BF, TC4514BP, TC4515BP, TC4555BP, TC4556BP/BF
DISPLAY DRIVER	LED		TC4511BP/BF, TC5002BP, TC5022BP
	LCD		TC4054BP/BF, TC4055BP, TC4056BP/BF, TC4543BP/BF
	DIGITRON		TC5068BP, TC5069BP
ENCODER			TC4532BP
REGISTERS	SHIFT		TC4006BP, TC4014BP, TC4015BP/BF, TC4021BP, TC4034BP, TC4035BP TC4094BP/BF, TC40104BP, TC40194BP, TC5050P
	STORAGE		TC4076BP
COUNTERS	BINARY		TC4029BP/BF, TC40161BP, TC40163BP, TC40193BP, TC4516BP/BF, TC4520BP/BF TC5018BP, TC5027BP
	DECADE		TC40209BP/BF, TC40160BP, TC40162BP, TC40192BP, TC4510BP/BF, TC4518BP/BF TC5026BP
	DIVIDER		TC4020BP/BF, TC4024BP/BF, TC4040BP/BF, TC4521BP, TC5036P, TC5048P
	DIVIDE-BY-"N"		TC4018BP, TC40102BP, TC40103BP, TC4522BP, TC4526BP/BF
	N-DIGIT DECADE		TC5001P, TC5032P, TC5037P, TC5051P, TC5052P, TC5053P, TC5054P, TC5070P
	OTHER		TC4017BP/BF, TC4022BP
TIMERS			TC5043P, TC5071P, TC5072P
MULTI-PLEXERS	ANALOG		TC4051BPBG, TC4052BP/BF, TC4053BP/BF
	DIGITAL		TC4512BP/BF, TC4539BP.BF, TC5023BP
ARITHMETIC CIRCUITS	ADDER		TC4008BP, TC4032BP, TC4038BP, TC4560BP
	COMPARATOR		TC4063BP/BF, TC4585BP
	PARITYTREE		TC4531BP
	RATE MULTIPLIER		TC4527BP
	9's COMPLEMENTER		TC4561BP
MEMORIES (RAM)			TC4036BP, TC4039BP
A/D CONVERTERS			TC5090AP, TC5091AP, TC5092AP, TC5093AP
ANALOG SWITCH			TC4016BP/BF, TC4066BP/BF
OTHER			TC40117BP

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Toshiba.
Customer Solutions in Microcontroller Products.

Toshiba offers a large variety of 4-bit microcontrollers with on-board functions including LCD, LED, VFD, PWM outputs, watchdog timers, SIO, A/D, D/A, dual clock, beep output, DTMF generator and standard timer/counters. These microcontrollers can be used in a wide range of applications, such as appliances, industrial controllers, telephones, televisions, VCRs, lighting equipment, meters and most other consumer applications. To make code development simple, Toshiba offers In-Circuit Emulators, piggybacks, EPROMs, and One Time Programmable Devices.

TLCS-47E SERIES

PART NUMBER	FUNCTIONS	ROM BYTES	RAM (NIBBLE)	I/O PORT	PACKAGE
TMP47C101P TMP47C191M	STANDARD LED DRIVERS (8 BITS)	1K	128	11	DIP 16 SOP 16
TMP47C201P TMP47C201M		2K			DIP 16 SOP 16
TMP47C102P TMP47C102M		1K	128	15	DIP 20 SOP 20
TMP47C202P TMP47C202M		2K			DIP 20 SOP 20
TMP47C103N TMP47C103M	STANDARD LED DRIVERS (12 BITS)	1K	128	23	SDIP 28 SOP 28
TMP47C203N TMP47C203M		2K			SDIP 28 DOP 28
TMP47C241N TMP47C241M	LED DRIVERS (5 BITS) 8 BIT A/D x 4CH	2K	128	21	SDIP 28 SOP 28

TLCS-47 SERIES

PART NUMBER	FUNCTIONS	ROM (bit)	RAM (bit)	I/O (bit)	MINIMUM CYCLE TIME (S)	SUPPLY VOLTAGE (V)	PACKAGE
TMP47C200AN TMP47C200AF	STANDARD (LED DRIVER)	2048 x 8	128 x 4	36	1.9	4.5 - 6.0	42-PIN SDIP 44-PIN PQFP
TMP47C400AN TMP47C400AF		4096 x 8	256 x 4				
TMP47C460AN TMP47C460AF				58			64-PIN SDIP
TMP47C210AN TMP47C210AF	VFT DRIVER	2048 x 8	128 x 4	36			42-PIN SDIP 44-PIN PQFP
TMP47C410AN TMP47C410AF		4096 x 8	256 x 4				
TMP47C212AN		2048 x 8	128 x 4	35			42-PIN SDIP
TMP47C412AN		4096 x 8	256 x 4				
TMP47C475AN	D/A CONVERSION PWM OUTPUT/WATCHDOG TIMER DUAL CLOCK			55	1.9 (244)		64-PIN SDIP
TMP47C220AF	LCD DRIVER	2048 x 8	192 x 4	28	1.9		67-PIN PQFP
TMP47C420AF		4096 x 8	256 x 4				
TMP47C221AF		2048 x 8	192 x 4				64-PIN PQFP
TMP47C421AF		4096 x 8	256 x 4				
TMP47P421AF		OTP 4096 x 8					
TMP47C423AF	HIGH SPEED EVENT COUNTER	4096 x 8					
TMP47C425AF	DUAL CLOCK SYSTEM			27	1.9 (244)		67-PIN PQFP
TMP47C231AN	4-BIT A/D CONV. INPUT, 8-BIT SERIAL I/O REMOTE CONTROL PRE-PROCESSING	2048 x 8	128 x 4	24			30-PIN SDIP
TMP47C232AN	D/A CONVERSION — 3-STATE A/D CONVERSION INPUT			36			42-PIN SDIP
TMP47C432AN		4096 x 8	256 x 4				
TMP47C233AN	LED DRIVER — 3-BIT A/D CONVERSION INPUT	2048 x 8	128 x 4				
TMP47C433AN		4096 x8	256 x 4				
TMP47C236AN	OSD (3-COL)	2048 x 8	128 x 4	22			
TMP47C336AN		3072 x 8	192 x 4				
TMP47C237AN	OSD (BAR DISPLAY)	2048 x 8	128 x 4	24			30-PIN SDIP
TMP47C337AN		3072 x 8	192 x 4				
TMP47C242AN	A/D CONVERTER — LED DRIVER	2048 x 8	128 x 4	23			
TMP47C440AN TMP47C440AF		4096 x 8	256 x 4	34			42-PIN SDIP 44-PIN PQFP
TMP47C441AN TMP47C441AF	WATCHDOG TIMER — VFT DRIVER						
TMP47C446AF	LCD DRIVER DUAL CLOCK			24	1.9 (244)		64-PIN PQFP
TMP47C451AN	DTMF GENERATOR — BEEP OUTPUT		768 x 4	23	16.7	2.2 - 6.0	30-PIN SDIP
TMP47C452AN TMP47C452AF				35			42-PIN SDIP 44-PIN PQFP
TMP47C455AF	LCD DRIVER DUAL CLOCK				8.3/16.7 (244)		60-PIN PQFP
TMP47C456AF					8.3 (244)	2.7 - 6.0	
TMP47C453AN TMP47C453AF					8.3	2.2 - 6.0	42-PIN SDIP 44-PIN PQFP

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TLCS-470 SERIES

PART NUMBER	FUNCTIONS	ROM (bit)	RAM (bit)	I/O (bit)	MINIMUM CYCLE TIME (S)	SUPPLY VOLTAGE (V)	PACKAGE
TMP47C800N TMP47C800F	STANDARD (LED DRIVER)	8192 x 8	512 x 4	36	1.3 (244)	4.5 - 6.0	42-PIN SDIP 44-PIN PQFP
TMP47P800N TMP47P800F		OTP 8192 x 8					
TMP47P800E		EPROM 8192 x 8					
TMP47C620F	LCD DRIVER HIGH SPEED TIMER/COUNTER	6144 x 8	384 x 4				42 PIN CERDIP WITH WINDOW
TMP47C820F		8192 x 8	512 x 4				80-PIN PQFP
TMP47P820F		OTP 8192 x 8					
TMP47CE820F	ON-CHIP EEPROM 64 X 8 BIT	8192 x 8					
TMP47C434N TMP47C434F	DISPLAY ON SCREEN CIRCUIT D/A CONVERSION (PWM) OUTPUT 3-BIT A/D CONVERSION INPUT REMOTE CONTROL PRE-PROCESSING LED DRIVER	4096 x 8	256 x 4	28	1.9		42-PIN SDIP 44-PIN PQFP
TMP47C634N TMP47C634F		6144 x 8	384 x 4				
TMP47C834N		8192 x 8	512 x 4	30			42-PIN SDIP
TMP47P834N		OTP 8192 x 8					
TMP47C635N		8144 x 8	384 x 4	41			54-PIN SDIP
TMP47C850N	BEEP OUTPUT OTMF RECEIVER, LED DRIVER	8192 x 8	512 x 4	52	2.2 (244)	4.5 - 5.5	64-PIN SDIP
TMP47C856F			1024 x 4	36	1.3 (244)	2.7 - 6.0	80-PIN PQFP
TMP47C858F	DTMF GENERATOR, LCD DRIVER		512 x 4				100-PIN PQFP
TMP47C660N TMP47C660F	8-BIT A/D CONVERTER REMOTE CONTROL PRE-PROCESSING LED DRIVER	8144 x 8	384 x 4	56		4.5 - 6.0	64-PIN SDIP 64-PIN PQFP
TMP47C860N TMP47C860F		8192 x 8	512 x 4				
TMP47P860N TMP47C860F		OTP 8192 x 8					
TMP47P860E		EPROM 8192 x 8					64-PIN SDIC WITH WINDOW
TMP47C662N	VFT DRIVER PULSE GENERATOR	6144 x 8	384 x 4	55			64-PIN SDIP
TMP47C862N		8192 x 8	512 x 4				
TMP47C670N TMP47C670F	VFT DRIVER D/A CONVERSION (PWM) OUTPUT 4-BIT A/D CONVERSION INPUT REMOTE CONTROL PRE-PROCESSING	8144 x 8	384 x 4	53			64-PIN SDIP 64-PIN PQFP
TMP47C870N TMP47C870F		8192 x 8	512 x 4				
TMP47P870N TMP47P870F		OTP 8192 x 8					
TMP47P870E		EPROM 8192 x 8					64-PIN SDIC WITH WINDOW

TLCS-470A SERIES

PART NUMBER	FUNCTIONS	ROM (bit)	RAM (bit)	I/O (bit)	MINIMUM INSTRUCTION EXECUTION TIME (S)	SUPPLY VOLTAGE (V)	PACKAGE
TMP47C1238N	ON-SCREEN DISPLAY D/A CONVERSION (PWM) OUT 4-BIT A/D CONVERSION INPUT REMOTE CONTROL PREPROCESSING	12888 x 8	512 x 4	39	1.3 (244)	4.5 - 6.0	54-PIN SDIP
TMP47C1638N		16384 x 8					
TMP47C1260N	LED DRIVER 8-BIT A/D CONVERTER REMOTE CONTROL PREPROCESSING	12288 x 8	768 x 4	56			64-PIN SDIP
TMP47C1660N		16384 x 8					
TMP47C1270N	VFT DRIVER D/A CONVERSION (PWM) OUT 4-BIT A/D CONVERSION INPUT REMOTE CONTROL PREPROCESSING	12288 x 8		53			
TMP47C1670N		16384 x 8					

TLCS-90 HIGH PERFORMANCE 8-BIT MICROCONTROLLER

KEY FEATURES

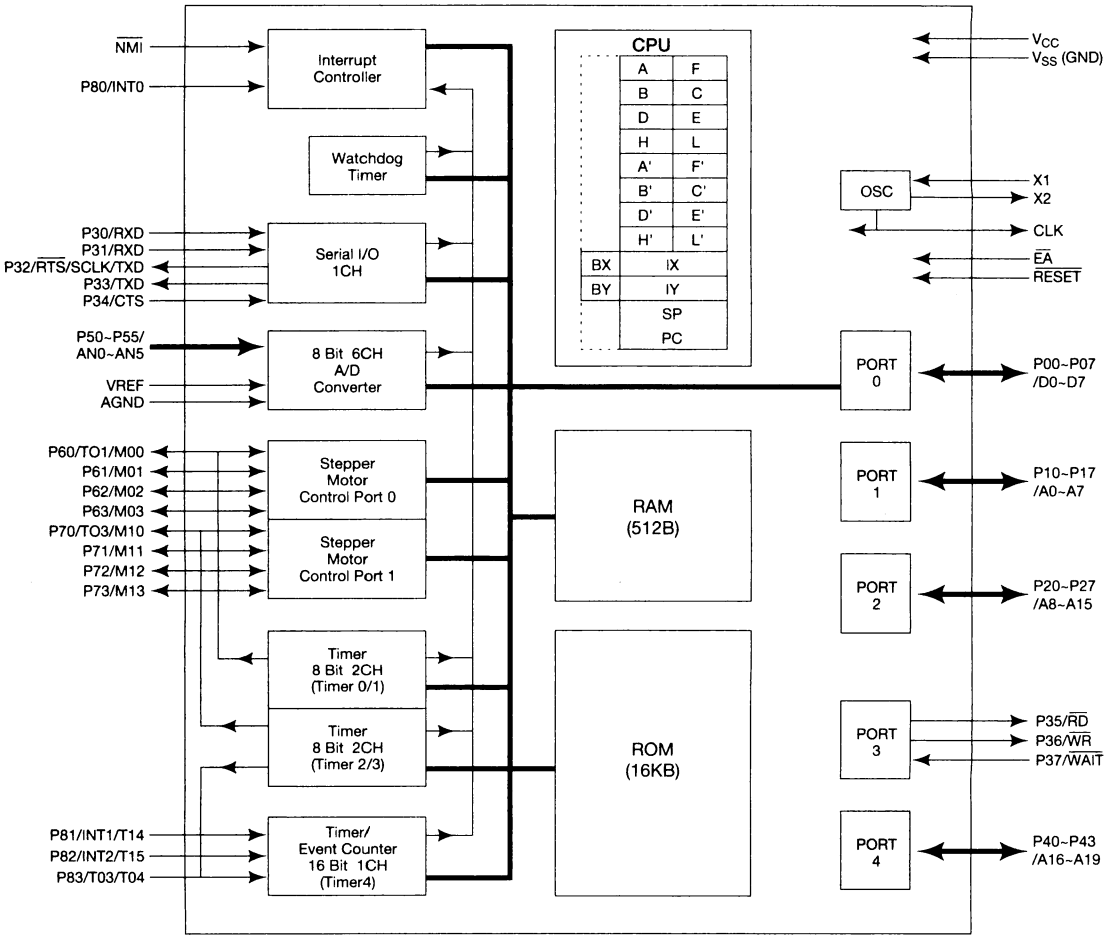
- ➤ Pipelined architecture with operational frequencies up to 16 MHz (250 ns minimum instruction cycle)
- ➤ On-chip clock generation
- ➤ Full and low power operating modes
- ➤ 163 basic instruction types including multiply, divide, bit manipulation and 16-bit arithmetic and logical instrùctions
- ➤ Up to 64KB program area, 1MB data area (8MB using MMU)
- ➤ On-board RAM/ROM options
- ➤ OTP and EPROM versions available
- ➤ On-board peripheral support

DEVELOPMENT SUPPORT

- ➤ Assembler, linker, librarian, on-screen debugger, C compiler
- ➤ In-circuit emulator

PERIPHERAL SUPPORT OPTIONS

- ➤ Bit I/O
- ➤ Serial I/O (asynchronous and synchronous modes)
- ➤ Multiple 8 and 16-bit counter/timers with programmable modes including PPG, PWM, event counting, interval timing and baud-rate generation
- ➤ Watchdog time
- ➤ Multiple 8-bit A/D converters
- ➤ Zero crossing detector
- ➤ 2-channel stepper motor controller
- ➤ Interrupt controller for internal and external interrupts
- ➤ Micro-DMA



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TLCS-90 FAMILY

DUAL-IN-LINE PKG. PART NUMBER	FLAT PACKAGE PART NUMBER	ROM (bytes)	RAM (bytes)	A/D (ch)	TIMER (bit x ch)	WATCHDOG TIMER	I/O PORTS	PWM (ch)	ZERO CROSS DETECT	µDMA (ch)
TMP90C840AN	TMP90C840AF	8K	256	6	8bitx4,16bitx1	YES	54	2	2	11
TMP90C841AN	TMP90C841AF	-	256	6	8bitx4,16bitx1	YES	28	2	2	11
TMP91C640N	TMP91C640F	16K	512	6	8bitx4,16bitx1	YES	54	2	2	11
TMP91C641N	TMP91C641F	-	512	6	8bitx4,16bitx1	YES	28	2	2	11
TMP91P640E-10	–	16K	512	6	8bitx4,16bitx1	YES	54	2	2	11
TMP91P640N-10	TMP91P640F-10	16K	512	6	8bitx4,16bitx1	YES	54	2	2	11
TMP90CM40N	TMP90CM40F	32K	1024	6	8bitx4,16bitx1	YES	54	2	2	11
TMP90PM40N	TMP90PM40F	32K	1024	6	8bitx4,16bitx1	YES	54	2	2	11
TMP90C041N	TMP90C041F	-	-	6	8bitx4,16bitx1	YES	28	2	2	11
TMP90C141N	TMP90C141F	-	1024	6	8bitx4,16bitx1	YES	28	2	2	11
TMP90C802AP	TMP90C802AM	8K	256	-	8bitx4	YES	32	1	1	4
TMP90P802AP	TMP90P802AM	8K	256	-	8bitx4	YES	32	1	1	4
TMP90C400N	TMP90C400F	4K	128	-	8bitx4	NO	56	1	4	8
TMP90C401N	TMP90C401F	-	128	-	8bitx4	NO	38	1	4	8
TMP90P800N	TMP90C800F	8K	256	-	8bitx4	NO	-	1	4	8
TMP91C642N	TMP91C642F	16K	320	4	8bitx4	YES	56	3	0	11
TMP90C844N	TMP90C844F	8K	256	4	8bitx4,16bitx1	YES	54	2	0	13
TMP90PH44N	TMP90PH44F	16K	512	4	8bitx4,16bitx1	YES	54	2	0	13
TMP90C845N	TMP90C845F	-	512	4	8bitx4,16bitx1	YES	36	2	0	11

TLCS-Z80 APPLICATION SPECIFIC STANDARD PRODUCTS (ASSPs)

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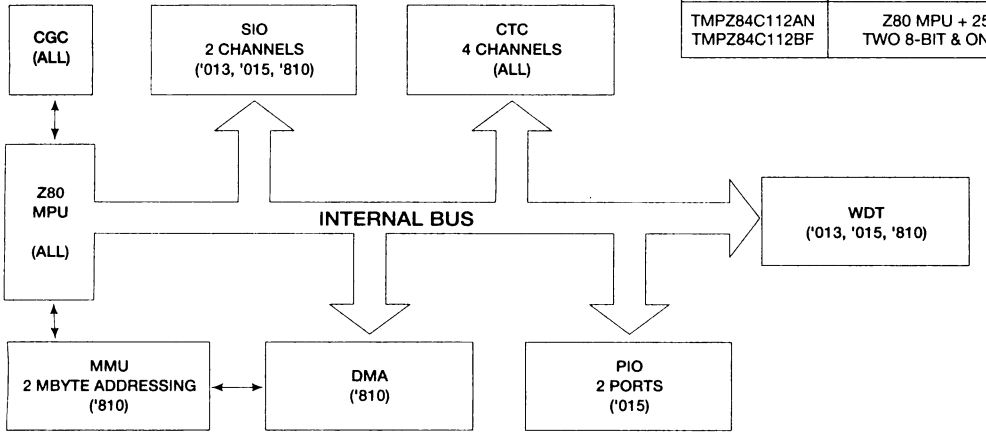
TLCS-Z80 FEATURES

- ➤ Z80 based Application Specific Standard Product (ASSP)
- ➤ Industry Standard CGC, CTC, DMA, SIO, PIO and MMU
- ➤ Watchdog timer, RAM and additional I/O
- ➤ Industry standard development tools can be used for debug and test
- ➤ Available in 6, 8 and 10 MHz versions

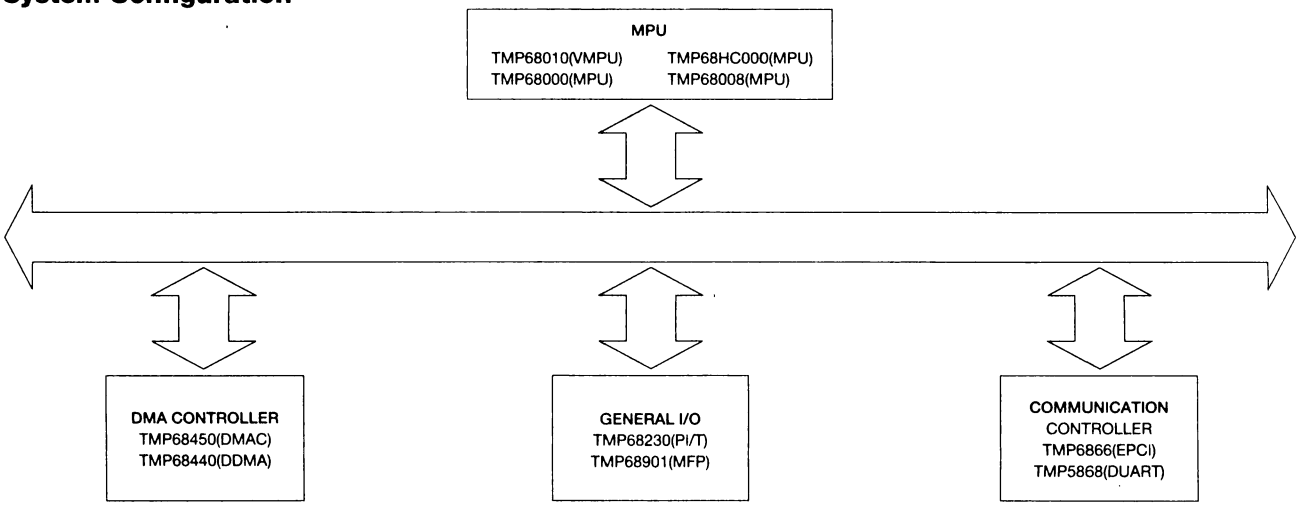
DEVICE	FEATURES	PACKAGE
TMPZ84C011BF	Z80 MPU + Z80 CGC + Z80 CTC + FIVE 8-BIT I/O PORTS	100-PIN PQFP
TMPZ84C013AT	Z80 MPU + Z80 CGC + Z80 CTC + Z80 SIO + WATCHDOG TIMER	84-PIN PLCC
TMPZ84C015BF	Z80 MPU + Z80 CGC + Z80 CTC + Z80 PIO + Z80 SIO + WATCHDOG TIMER	100-PIN PQFP
TMPZ84C810BF	Z80 MPU + Z80 CGC + Z80 CTC + Z80 SIO + DMA + I/O + MMU (2MB PROGRAM & DATA) + WATCHDOG TIMER	100-PIN PQFP
TMPZ84C112AN TMPZ84C112BF	Z80 MPU + 256 BYTES RAM + TWO 8-BIT & ONE 5-BIT I/O PORTS	64-PIN SDIP 64-PIN PQFP



TOSHIBA AMERICA ELECTRONIC COMPONENTS, INC.

16-BIT MICROPROCESSORS
TLCS-68000 SERIES

System Configuration



Clock Rates and Package Type of the TLCS-68000 Family

DEVICE NO.	DEVICE NAME	PROCESS	SPEEDS (MHZ)	DIP	CERAMIC PGA	
				PLASTIC	WITH STANDOFFS	WITHOUT STANDOFFS
TMP68000	MPU	N	8,10,12.5	64	–	68
TMP68008	MPU	N	8,10	48	–	–
TMP68010	VMPU	N	8,10, 12.5	64	–	–
TMP68230	PI/T	N	8,10	48	–	–
TMP68450	DMAC	N	8,10	64	–	–
TMP68451	MMU	N	8,10	–	68	–
TMP68HC000	MPU	C	10, 12.5, 16	64	68	–
TMP68681	DUART	N	1Mbps	40	–	–
TMP68901	MFP	N	4	48	–	–
TMP68440	DDMA	N	8,10	64	–	–
TMP68661	EPCI	N	1Mbps	28	–	–

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8-BIT MICROCONTROLLERS
TMP68HC05/11 SERIES

Product List

PRODUCT NUMBER	ROM (bytes)	EEPROM (bytes)	RAM (bytes)	I/O PORT (bytes)	MINIMUM INSTRUCTION EXECUTION TIME (μS)	CLOCK FREQUENCY FOSC (MHz)	SUPPLY VOLTAGE (V)	OPERATING TEMPERATURE (°C)	PACKAGE TYPE
TMP68HC05C4	4160	–	176	31	0.95	D.C. ~ 4.2	3.0 ~ 5.5	0 ~ +70	40-pin DIP
TMP68HC11A8	8K	512	256	38	0.95	D.C. ~ 8.4	4.5 ~ 5.5	-40.~ +85	64-pin SDIP *64-pin QFP 52-pin PLCC 48-pin DIP
TMP68HC11A1	–	512							
TMP68HC11A0	–	–							
TMP68HC11E9	12K	512	512	38	0.95	D.C. ~ 8.4	4.5 ~ 5.5	-40. ~ +85	64-pin SDIP *64-pin QFP 52-pin PLCC
TMP68HC11E1	–	512							
TMP68HC11E0	–	–							
TMP68HC711J6	16K (EPROM)	–	512	54	0.47	D.C. ~ 16.8	4.5 ~ 5.5	-40. ~ 85	64-pin SDIP 68-pin PLCC

* Planned Product

PACKAGE DIP: Plastic Dual-in-line (Pin pitch: 2.54mm)
PLCC: Plastic Leaded Chip Carrier
SDIP: Shrink DIP (Pin pitch: 1.78mm)
QFP: Plastic Quad Flat Package

TOSHIBA AMERICA ELECTRONIC COMPONENTS, INC.

TMP68301/3/5 – 68HC000 BASED INTEGRATED MICROPROCESSORS

DEVICE FAMILY FEATURES

- 12.5, 16.67 MHz 68HC000 based integrated microprocessor
- Sophisticated address decoder – relocatable chip-select generation for internal peripherals and external chip-selects
- Built-in interrupt controller– 3 external plus internal channels with auto-vector interrupt generation
- Automatic DTACK generation with 0 to 7 wait-states and programmable BERR generation
- 100-pin plastic flat package

TMP68301 UNIQUE FEATURES

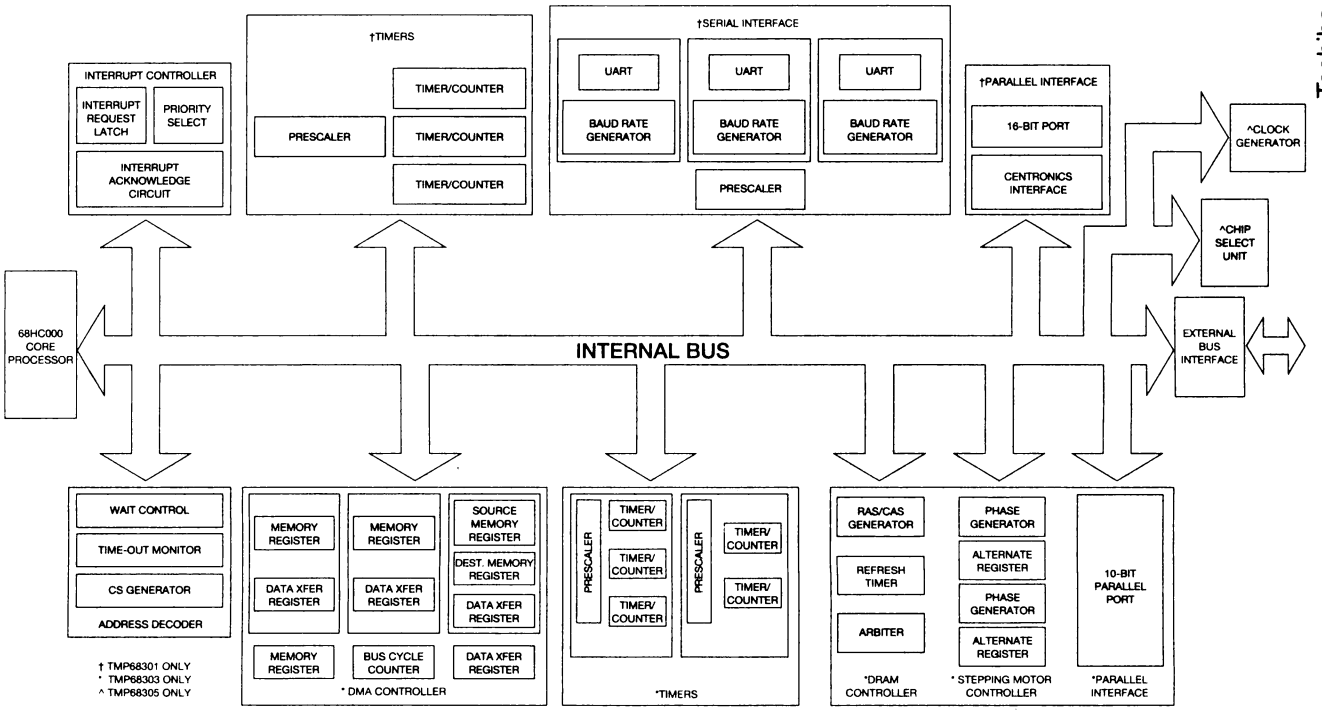
- 3 Asynchronous serial ports with baud rate generators and optional modem control
- 16-bit parallel interface with Centronics interface mode
- 3 timer channels, 16 bits each with an 8-bit prescaler

TMP68303 UNIQUE FEATURES

- 3 independent DMA channels capable of 8 Mbyte/sec transfer rate with 64KB blocks
- DRAM controller with programmable refresh and memory wait-states
- 2 Asynchronous serial ports with independent baud rate generators
- General purpose 10-bit parallel interface
- 2 channel stepping motor controller
- 4 timer channels– two 16-bit with 8-bit prescaler and two 8-bit with 9-bit prescaler
- 16-bit watchdog timer with system reset output

TMP68305 UNIQUE FEATURES

- 2 independent DMA channels capable of 8 Mbyte/sec transfer rate with 128KB blocks
- 2 Asychronous serial ports with baud rate generators
- 16-bit timer with 8-bit prescaler
- On-board clock generator



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TOSHIBA AMERICA ELECTRONIC COMPONENTS, INC.

NEURON PROCESSORS FOR DISTRIBUTED COMMUNICATION AND CONTROL APPLICATIONS

TMPN3150F, TMPN3120F

TMPN3150F FEATURES

- Three 8-bit pipelined processors
- External memory bus interface
- Eleven-pin I/O port programmable in 25 modes
- Two 16-bit timer/counters
- Five-pin communication port to support network transceivers
- 2048 bytes of static RAM
- 512 bytes of EEPROM with on chip charge pump
- Sleep mode to reduce power consumption
- Unique 48-bit ID number in every device

TMPN3120F FEATURES

Features all of TMPN3150F except:

- No external memory bus interface
- 1024 bytes of RAM space
- 10K bytes of ROM used for internal chip firmware

TMPN3150F/TMPN3120F processors are used to develop distributed intelligent nodes that can be interfaced via different media such as twisted pair, power lines, RF signals, etc. The Neuron processors have built in operating systems, and complete network protocol firmware implementing all 7 layers of OSI network standard. Two of the three processors inside the neuron chips are dedicated to running the operating system and network protocol firmware, respectively. The third process is used for user application programs. The TMPN3150F is tailored for more sophisticated applications requiring more firmware space, while TMPN3120F is optimized for stringent space and cost reduction requirements.

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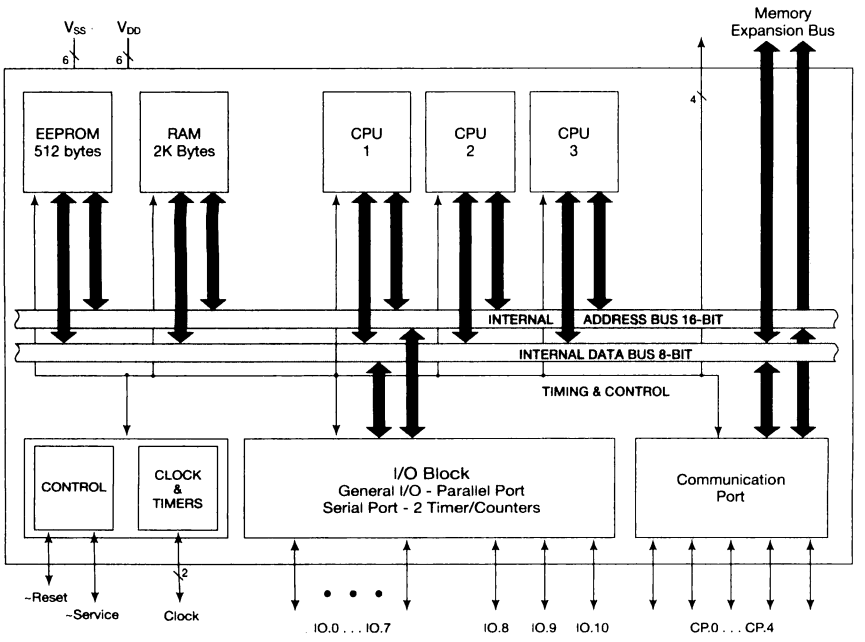
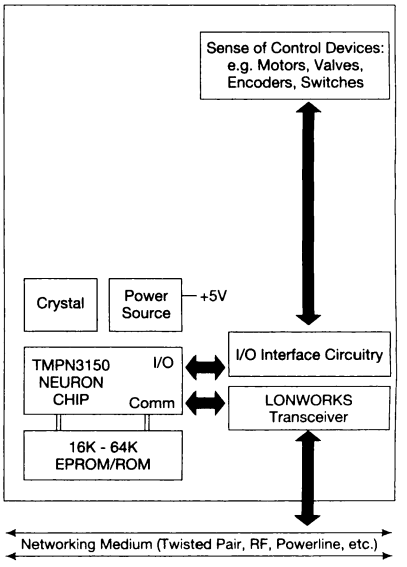
TMPN3150F BLOCK DIAGRAM



TMPN3150F APPLICATION DIAGRAM



TOSHIBA AMERICA ELECTRONIC COMPONENTS, INC.

CMOS MICROCOMPUTER PERIPHERAL LSI
Powerful Microprocessor Peripherals

- ➤ Total CMOS solution for low power consumption and heat dissipation
- ➤ Many devices compatible with accepted industry standards
- ➤ Many devices available in both DIP and surface mount packages

TYPE NUMBER	PACKAGE		DESCRIPTION	COMPATIBLE PART	PRODUCTION AVAILABILITY
TC8250AP	16-PIN DIP	RTC	REAL TIME CLOCK/CALENDAR	TOSHIBA ORIGINAL	NOW
TC8521P	18-PIN DIP				
TC8505AP	40-PIN DIP	CRTC	CRT DISPLAY CONTROLLER	MOTO/HITACHI 6845 (NMOS) PINOUT	NOW
TC8505AF	44-PIN MFP				
T7518	144-PIN QFP	HDC	HARD DISK CONTROLLER	TOSHIBA ORIGINAL	NOW
TC85041F	100-PIN QFP	BIA	BUS INTERFACE ADAPTER PC/AT	TOSHIBA ORIGINAL	NOW
TC8540F					
TC8541F					
TC8563AF	60-PIN QFP	VFO	VFO FOR HDC	TOSHIBA ORIGINAL	NOW
TC8564AF					
TC8565AP	40-PIN DIP	FDC	FLOPPY DISK CONTROLLER	NEC μPD765 INTEL 8272A	NOW
TC8565AF	44-PIN MFP				
TC8566AF	100-PIN MFP			FDC WITH VCO	NOW
TC8568AM	28-PIN SOIC	VFO	VFO FOR FLOPPY DISK	TOSHIBA ORIGINAL	NOW
TC8569AF	80-PIN MFP	FDC	FLOPPY DISK CONTROLLER (PERPENDICULAR RECORDING)		NOW
TC85069F					NOW
TC8576AF	44-PIN MFP	CPC	CENTRONICS I/O + RS232C	TOSHIBA ORIGINAL	NOW
TC8577AP	40-PIN DIP		CENTRONICS OUTPUT + RS232C		
TC8578AP	40-PIN DIP		CENTRONICS INPUT + RS232C		
T7779	100-PIN FP	LCD/CRTC	LCD/CRT CONTROLLER 640X 400 DOT MATRIX	MOTO/HITACHI 6845 (SOFTWARE)	NOW
T7889A	100-PIN FP	LCD	ROW/COLUMN DRIVER/CONTROLLER		NOW
T7934	80-PIN FP	LCD	LCD CONTROLLER/DRIVER/(40 DIGIT X 16 LINES)		
T6963C	67-PIN MFP	LCD	LCD CONTROLLER (80 DIGIT X 16 LINES)	TOSHIBA ORIGINAL	NOW
TC8506M	28-PIN SOP	LUT	LOOK UP TABLE RAM W/DAC	TOSHIBA ORIGINAL	NOW
TC8507P	40-PIN DIP				
TC8554F	100-PIN QFP	ODC	ERROR CORRECTION FOR OPTICAL DISK	TOSHIBA ORIGINAL	NOW
TC8570AP	44-PIN QFP	UART	UNIVERSAL ASYNCHRONOUS R/T	TOSHIBA ORIGINAL	NOW
TC8570AF					

Toshiba America

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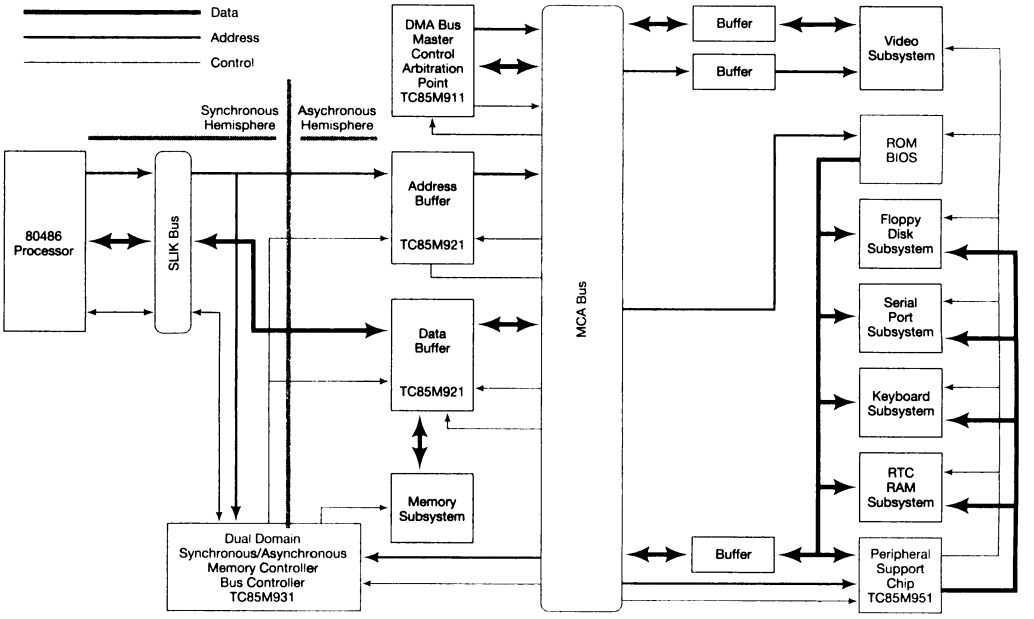
Chipset for 80486 Micro Channel™ Computer Systems

- SLIK architecture supports the 80486 microprocessor
- Five chip implementation of a Micro Channel computer system:
  - ➤ TC85M911 Bus Master DMA Controller
  - ➤ TC85M921 Address/Data Buffer (2 required)
  - ➤ TC85M931 Memory/Bus Controller
  - ➤ TC85M951 Peripheral Support Chip
- Supports Weitek 4167 math coprocessor
- Hardware and Software compatible with IBM's Micro Channel Architecture
- Operates at either 25 or 33 MHz
- Supports i486™ Turbocache 486™ secondary cache module
- Fabricated using 1.0 micron CMOS technology
- Packaged in 144, 160 and 184 pin plastic quad flat packs (PQFPs)



The Toshiba Short Line Interface Kernel (SLIK™) system architecture provides both the concept and components needed to design a high-performance 80486 based computer using the IBM Micro Channel Architecture. The SLIK architecture is designed to provide a consistent system design and a common software viewport to system I/O regardless of the specific processor used– thus allowing easy migration to faster and more powerful processors.

Toshiba's SLIK chipset is completely hardware and software compatible to IBM's Micro Channel Architecture.

In addition, enhancements are added to boost a system's performance and functionality.

Clock speeds of 25 and 33 MHz are supported allowing the design of both entry-level and workstation-class 80486 systems.

The Toshiba SLIK chip set greatly eases the design and fabrication of high-performance 80486 based Micro Channel computer systems. High levels of integration and performance are achieved while at the same time offering low power consumption, fewer components, small size and low EMI.

Micro Channel is a trademark of International Business Machines Corporation.

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Toshiba America

UNIVERSAL SEMICONDUCTOR INC.

PROCESS TECHNOLOGIES FOR CUSTOM/SEMI CUSTOM SOLUTIONS

Dielectrically Isolated High Voltage Process

Our USH5000 Smart Power technology allows virtually unlimited interconnection of circuits operating at up to 500 volts. In addition to high voltage drive circuitry, 5-15 volts analog and digital CMOS and bipolar control circuitry can be integrated on the same monolithic IC. Dielectric isolation processing provides enhanced operating conditions and improved reliability.

Applications include automatic test equipment, flat panel displays, electrostatic printers, smart motor control, ultrasound imaging, and telephone loop equipment.

CMOS Gate Arrays

Our ISO-CMOS series offers economical solutions for digital applications with up to 2400 gates. 2, 3, and 5 MICRON technology achieves high speed and low power with operating range up to 25 volts. ISO-RAD processing provides radiation tolerance of 1 megarad.

Our Unique Standard Products

Product/ Package	Function	Features	Applications
USH5008 24 PIN	180 Volt 8-Channel Analog Switch	DC to 10 MHz Analog Signal Frequency. 30 Ohm Ron, 2µs Ton/Toff, 45 dB RF Isolation Low Power Dissipation, Low Leakage, Total immunity to latch up	Ultrasound imaging Applications requiring flexible high voltage switching controlled by internal CMOS logic
USH5010 24 Pin	300 Volt 8-Channel Analog Switch	8 Bidirectional Analog Switch All other features same as USH5008	—
USH5501 6 Pin	250 Volt Monolithic AC/DC Relay	Low Ron, 2500V Isolation, Zero voltage offset, Low offset leakage, 100% immunity from false turn-on, High sensitivity detector and proprietary pull down circuit	Ideal for telecom or data acquisition signal switching applications
USH5551 6 Pin	400 Volt Monolithic AC/DC Relay	Same as USH5501	Pin to Pin replacement of AT&T LH1056/1156 with higher breakdown voltages
USH5155 18 Pin	500 Volt Kit Part	Contains H.V. N and P Channel Enhancement Mode. DMOS FETs, IGT, Thyristor and Diode. Also low voltage CMOS Inverter	Designed for breadboarding circuits that are to be integrated into a single chip
USH5156 16 Pin	500 Volt Kit Part	Contains H.V. N-Channel Depletion Mode and N and P Channel Enhancement Mode DMOS FETs NPN Bipolar Transistor	Same as above
USC1850/1852 24/20 Pin	8 Bit 85 MHz Video DAC	Single +5V supply TTL/CMOS compatible, Low glitch energy, Adjustable current source, Normal or complement data 100mW Pd	Designed for enhanced graphic and imaging system. Pin to Pin replacement for Sierra SC11401/11402/11403/11404
USC1843 24 Pin	Triple 4 Bit Video DAC	Same as USC1850/1852	Replacement for SC11456 but with higher frequency

Universal Semiconductor

FOR FURTHER INFORMATION AND DATA SHEETS, CALL OR WRITE:
1925 ZANKER ROAD, SAN JOSE, CA 95112 • TEL: 408/436-1906 • FAX:408/436-1125

UNIVERSAL SEMICONDUCTOR INC.

Product/ Package	Function	Features	Applications
USC1863 28 Pin	Triple 6 Bit Video DAC	Same as USC1850/1852	Replacement for SC1147 but with higher frequency
USC68HC138 24 Pin	Address Decoder Circuit	Interfaces directly with 68000 family of microprocessor. TTL compatible, high speed, low power	—
USC68HC551 24 Pin	Asynchronous Communication Interface Adapter	Interfaces directly with 68000 family of microprocessor. TTL compatible, high speed, low power	—
USC68HC908 24 Pin	Programmable Interrupt Controller	Interfaces directly with 68000 family of microprocessor. TTL compatible, high speed, low power	—
SD210/212/214 TO - 72	DMOS FETs	N-Channel Enhancement Mode SD210: 30V/45 Ohm SD212: 10V/45 Ohm SD214: 20V/45 Ohm Self aligned silicon gate structure. No gate protective diode	Switch drivers, Analog switches, Sample and hold. Video switch Track and Hold
SD211/213/215 TO - 72	DMOS FETs	N-Channel Enhancement Mode SD211: 30V/45 Ohm SD213: 10V/45 Ohm SD215: 20V/45 Ohm Self aligned silicon gate structure. Have gate protective diode	Same as above
SD5000/ 5001/5002 16 Pin	Quad DMOS FET Analog Switch Arrays	N-Channel Enhancement Mode SD5000: 20V/50 Ohm SD5001: 10V/50 Ohm SD5002: 15V/50 Ohm Self aligned silicon gate structure	Used in Analog Multiplexers, Comparators, Cross point switches, Sample and hold circuits
SD5100/ 5101/5200 14/16 Pin	Quad DMOS FET Analog Switch Driver Array	N-Channel Enhancement Mode SD5100: 30V/50 Ohm, Common Source SD5101: 15V/50 Ohm, Common Source SD5200: 30V/50 Ohm, Four Source	Switch drivers, Current summing, Multiplexers, Analog comparators, Sample and hold
SD5400/ 5401/5402 14 Pin SOIC	Quad DMOS FET, Analog Switch Array	N-Channel Enhancement Mode SD5400: 20V/30 Ohm SD5401: 10V/30 Ohm SD5402: 15V/30 Ohm	High speed Analog switch, Switch drivers, Sample and hold
TMF120/ 121/122/123 TO - 99	Dual DMOS FETs	N-Channel Enhancement Mode Vds = 25V Vgs(th) = 0.5 to 1.5V Ron = 60 Ohm Differential Gate Source Voltage TMF120: 5mV; TMF 122: 25mV TMF121: 10mV; TMF 123: 50mV	High speed Analog comparators, Wide band differential amplifiers and source followers, Sample hold, Cascade and cascade amplifier

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VITELIC

PRODUCT SUMMARY

DRAMs

Organization	P/N	Access Time(ns) 45	50	60	70	80	100	Maximum Current Operating†	Standby	Packages J	K	P	Z	Product Features
256K x 1	V53C256+				•	•	•	60mA	1.2mA	•		•		Fast Page, CMOS, High Speed Memory
256K x 1	V53C258+				•	•	•	60mA	1.2mA	*		•		Static Column, CMOS, High Speed Memory
64K x 4	V53C464+				•	•	•	65mA	1.2mA	•		•		Fast Page, CMOS, High Speed Graphic Memory
64K x 4	V53C466+				•	•	•	65mA	1.2mA	•		•		Static Column, CMOS, High Speed Graphic Memory
64K x 8	V53C864				•	•	•	65mA	1mA		•	•		Fast Page, CMOS,High Speed Graphic, Laptop Memory
64K x 8	V53C866				•	•	•	65mA	1mA		•	•		Static Column, CMOS, High Speed Graphic, Laptop Memory
1M x 1	V53C100A				•	•		65mA	1mA		•	•		Fast Page, CMOS, Memory
1M x 1	V53C100B			•	•	•		70mA	0.25mA		•	•		Fast Page, CMOS, High Speed, Low Power Memory
1M x 1	V53C100H	•	•	•				85mA	0.15mA		•	•	*	Fast Page, CMOS, High Speed, Low Power Memory
256K x 4	V53C104A				•	•		65mA	1mA		•	•		Fast Page, CMOS, Memory
256K x 4	V53C104B			•	•	•		70mA	0.25mA		•	•		Fast Page, CMOS, High Speed, Low Power Memory
256K x 4	V53C104H	•	•	•				85mA	0.15mA		•	•	*	Fast Page, CMOS, High Speed, Low Power Memory
64K x 16	V53C664					•	•	90mA	0.2mA		•		*	Fast Page, CMOS, Graphic Memory w/Upper/Lower Byte Control
64K x 16	V53C665					•	•	90mA	0.2mA		•		*	Fast Page, CMOS, Graphic Memory with Write Per Bit
64K x 16	V53C666					•	•	90mA	0.2mA		•		*	Static Column, CMOS, Graphic Memory w/Upper/Lower Byte Control
1M x 4	V53C404				•	•	•	100mA	*		•		*	High Performance, 4 Megabit DRAM Family
4M x 1	V53C400				•	•	•	100mA	*		•		*	High Performance, 4 Megabit DRAM Family

VIDEO RAMs

Organization	P/N	Access Time(ns) 70	80	100	120	Maximum Current Operating	Standby	Packages K	P	S	Z	Product Features
64K x 4	V53C261			•	•	50mA	6mA		•		•	Fast Page, Low Power, 256K-bit VRAM
256K x 4	V52C4256		•	•		110mA	10mA	*				Fast Page, 256K x 4 RAM, 512K x 4 SAM
	V52C4258		•	•								Fast Page, 256K x 4 RAM, 512K x 4 SAM, Split read/write transfer
128K x 8	V52C8126		•	•		110mA	10mA	•			*	Fast Page, 128K x 8 RAM, 256K x 8 SAM
	V52C8128		•	•				•			*	Fast Page, 128K x 8 RAM, 256K x 8 SAM, Split read/write transfer
256K x 8	V52C8256	•	•	•		120mA	10mA	•				Fast Page, 256K x 8 RAM, 512K x 8 SAM

+ "A"-shrink version of product included in Databook.
* Consult Factory for availability.
† Maximum operating current for slowest access time

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VITELIC

PRODUCT SUMMARY

MEMORY MODULES

Organization	P/N	Access Time(ns) 45	50	60	70	80	Maximum Current Modules Operating	Standby	L	S	Product Features
256K x 8	V256J8				•	•	480m	10mA	*	•	Fast Page, High Speed DRAM Module
(8 Chip version)											
256K x 9	V256J9				•	•	540m	11mA	*	•	Fast Page, High Speed DRAM Module
(9 Chip version)											
256K x 8	V104AJ8				•	•	130m	2mA	*	•	Fast Page, DRAM Module
	V104BJ8			•	•	•	140mA	0.5mA	*	•	Fast Page, High Speed, Low Power DRAM Module
(2 Chip version)	V104HJ8	•	•	•			170mA	3mA	*	•	Fast Page, High Speed, Low Power DRAM Module
256K x 9	V104AJ9				•	•	180mA	3mA	*	•	Fast Page, DRAM Module
(3 Chip version)											
256K x 36	V104AJ36				•	•	720mA	13mA		•	Fast Page, Low Power 32-Bit Data Path DRAM Module
(12 Chip version)											
512K x 36	V104AJ236				•	•	1440mA	26mA		•	Fast Page, Low Power, 32-Bit Data Path DRAM Module
(24 Chip version)											
1M x 8	V100AJ8				•	•	520mA	8mA	*	•	Fast Page, High Speed DRAM Module
	V100BJ8			•	•	•	560mA	1.6mA	*	•	Fast Page, High Speed, Low Power DRAM Module
(8 Chip version)	V100HJ8	•	•	•			680mA	1.2mA	*	•	Fast Page, High Speed, Low Power DRAM Module
1M x 9	V100AJ9				•	•	585mA	9mA	*	•	Fast Page, High Performance DRAM Module
	V100BJ9			•	•	•	630mA	1.8mA	*	•	Fast Page, High Speed, Low Power DRAM Module
(9 Chip version)	V100HJ9	•	•	•			765mA	1.35mA	*	•	Fast Page, High Speed, Low Power DRAM Module
(3 Chip version)	V404J9				•	•	230mA	*	*	•	Fast Page, High Performance DRAM Module
4M x 8	V400J8				•	•	720mA	*	*	•	Fast Page, High Performance DRAM Module
4M x 9	V400J9				•	•	640mA	*	*	•	Fast Page, High Performance DRAM Module

* Consult Factory for availability.

CACHE SRAMs

Organization	P/N	Access Time(ns) 25	30	35	40	45	Maximum Current Operating	Standby	Packages J	Product Features
8K x 16/2 x 4K x 16	V63C328		•		•	•	140mA	6mA	•	Integrated Cache Memory for 32KB-64KB, 386 Systems
8K x 16/2 x 4K x 16	V63C330	•	•	•		•	140mA	6mA	•	Integrated Cache Memory for 64KB-128KB, 386 Systems

* Consult Factory for availability.

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Vitelic Semiconductor

VLSI TECHNOLOGY, INC.

ASIC PRODUCTS

OVERVIEW

PUTTING IT ALL TOGETHER IN ASICS

Increased product performance and decreased time to market are the key issues that continue to drive today's marketplace.

As a recognized pioneer and leader in application-specific integrated circuit (ASIC) design, VLSI Technology provides today's system engineers with a complete and comprehensive set of products and services that allow complex ASICs to be developed, tested and manufactured with maximum efficiency.

In a tightly unified ASIC design and manufacturing environment, VLSI provides a full spectrum of ASIC solutions backed through our vast network of worldwide Technology Centers, access to highly-efficient and easy-to-use ASIC design software, unmatched gate array and standard cell libraries, and the manufacturing strength required for quick turnaround and high-volume production.

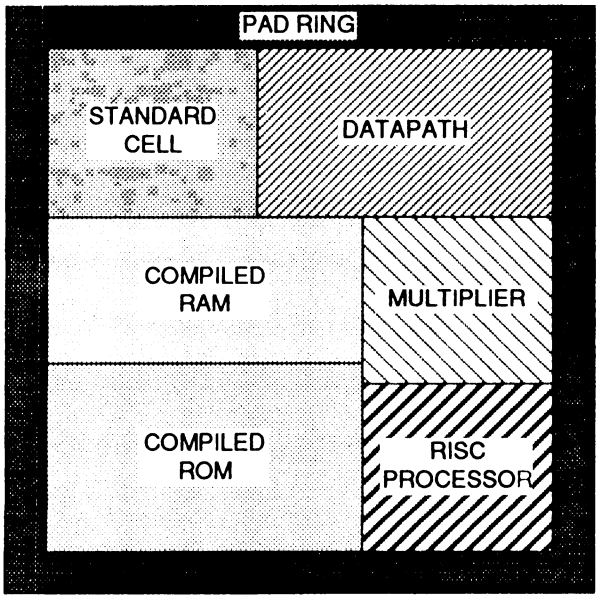
VLSI Technology provides the high degree of expertise needed in all of the areas required to take an ASIC from concept through design, prototyping and into production. VLSI's many years of experience as a full-service ASIC vendor ensure that all steps are performed in a cost-effective and timely manner, which enables you to develop competitive products and meet ever-reducing market windows.

PROVIDING EXPERT ASSISTANCE

VLSI's sales offices are staffed by experienced ASIC sales engineers, who understand your needs, and the many trade-offs involved in making an ASIC decision. Our sales engineers will help guide you through the process, providing technical and commercial assistance that make it easier for you to achieve your goals.

As part of the initial process, you will meet some of the experienced ASIC design engineers who staff our 35 design centers around the world. Twenty of those design centers are owned by VLSI Technology, and the others are independent Authorized Design Centers operating with the same tools and services as our own Technology Centers. These engineers will provide the technical data and evaluation services to help you choose the optimum process technology, library set and packaging.

ASIC IMPLEMENTATIONS



	Standard Cell			Gate Array		
	Technology (μ)					
	1.5	1.0	0.8	1.5	1.0	0.8
Portable Library	X	X	X	X	X	X
Datapath	X	X	X	X	X	X
RAM Compiler	X	X	X		X	X
Dual Port RAM	X	X	X		X	X
ROM Compiler	X	X	X		X	X
Multiplier Compiler	X	X	X		X	X
RISC Processor	X	X				

VLSI Technology

VLSI TECHNOLOGY, INC.

ASIC PRODUCTS

CMOS STANDARD CELL LIBRARIES AND COMPILERS

PRODUCT CHARACTERISTICS

	1.5-Micron	1.0-Micron		0.8-Micron*	
Standard Library	**VSC120**	**VSC350**	**VSC370**	**VSC400/450**	**VSC420/470**
Gate Delay	0.73 µs	0.35 µs	0.45 µs	0.25 µs	0.30 µs
Toggle Rate	180 MHz	250 MHz	250 MHz	> 300 MHz	> 300 MHz
Gate Power	6.5 µW/Gate/MHz	6.5 µW/Gate/MHz	3.6 µW/Gate/MHz	3.9 µW/Gate/MHz	1.7 µW/Gate/MHz
Output Drive	2, 4, 8, 12, 16 mA	2, 4, 6, 8, 16 mA	2, 4, 6, 8, 16 mA	1, 2, 4, 6, 8, 16, 24, mA	1, 2, 4, 6, 8, 16, 24 mA
Library Contents	225 Cells	299 Cells	299 Cells	> 300 Cells	> 300 Cells
Complex Functions					
Dual-Port RAM Compiler	VDPRAM100	VDPRAM300	VGC3NP01		
Ram Compiler	CRAM01 VGTRAM200 VSRAM100	CRAM03 CRAM01 CRAM02	VGC3RS2	VCC4RS1 VGC4RS2	
Datapath Compiler	VDP100	VDP300	VDP370	VCC4DP1 (Portable)	VCC4DP2 (Optimized)
Multiplier Compiler	CMLT01 CMLT02	VMLT03 CMLT02			
Multiplier Accumulator		VCM01			
ROM Compiler	CROM01	CROM01			

VLSI Technology

GATE ARRAY LIBRARIES

DESCRIPTION

VLSI's gate array libraries contain most commonly used macrocells including NAND, NOR, XNOR, OR, OR-AND-INVERT, buffers with various strength, D flip-flops, JK flip-flops, toggle flip-flops, latches, multiplexed flip-flops, scan flip-flops and latches, adders/subtracters, decoders and multiplexers. A variety of I/O cells are included such as TTL and CMOS I/Os, very fast clock input pads, crystal oscillator pads, three-state outputs, and slew rate outputs. The gate array libraries are upward-portable which provides easy design migration from technology upgrade. There are 335 macrocells in the VGT350 library, 299 in the VGT300, and 250 in the VGT200. VLSI's gate array libraries are fully supported by VLSI's tools and methodologies.

PRODUCT CHARACTERISTICS

Characteristics	**VGT200**	**VGT350/353**	**VGT450/453***
Technology (Drawn)	1.5-micron CMOS	1.0-micron CMOS	0.8-micron CMOS
Available Gates	3,200 to 180,000	21,200 to 172,500	30,000 to 250,000
I/O Count	48 to 348	140 to 388	160 to 440
Gate Delay	0.560 ns (Typ)	0.350 ns (Typ)	0.250 ns (Typ)
Toggle Rate	250 MHz	250 MHz	> 300 HHz
Gate Power @ Freq.	4.5 µW/Gate/MHz	6.5 µW/Gate/MHz	3.9 µW/Gate/MHz
Output Drive	2, 4, 8, 12, or 16 mA	2, 4, 8, 12, or 16 mA	1, 2, 4, 6, 8, 12, 16, or 24 mA
Temperature Range: Commercial Industrial Military	 0°C to + 70 °C -40°C to + 85°C 155°C to + 125°C	 0°C to + 70 °C -40°C to + 85°C 155°C to + 125°C	 0°C to + 70 °C -40°C to + 85°C 155°C to + 125°C

*Preliminary

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VLSI TECHNOLOGY, INC.

ARM/RISC

PRODUCT OFFERING

GENERAL DESCRIPTION

The ARM/RISC CPU and support chips from VLSI provide an inexpensive, yet powerful solution for embedded control applications. The 32-bit architecture has been optimized for software performance, video screen bit manipulation and fast response to interrupts. As a result, the ARM/RISC family lends itself well to applications such as laser printers, graphic accelerators, network managers or any other embedded application that requires a cost-effective yet fast real-time response to external events.

VLSI's ARM/RISC processors are fabricated in CMOS with a minimal transistor count. This combination produces the highest Computation to Power ratios of any competing CPU, making the ARM/ RISC processor well-suited for battery powered applications.

PHILOSOPHY

In keeping with VLSI's philosophy of providing our customers with the most flexibility, the ARM/RISC products are available in three major forms. The first form is that of a Functional System Block (FSB), which can be combined with other VLSI FSBs to create a custom silicon solution. To create the second form, VLSI has bonded out the FSB core into a standard package, and make these available for embedding into a custom board solution. For those designers interested in an even higher degree of integration, VLSI has combined the most common computing elements, such as Cache and Memory Management, into a single package.

FUNCTIONAL SYSTEM BLOCKS

The Functional System Block is the basic CPU core for the ARM/RISC product family. It is available as a library cell, which can be combined with other VLSI library cells or custom logic. The resulting design can then be fabricated into a single package. To make the design easier, test vectors and scripts are included with the FSB to assure simple integration with other logic.

The ARM2aS, is the basic ARM/RISC microprocessor core. It has a 32-bit architecture with a 26-bit address space.

The ARM6, is the enhanced ARM/RISC microprocessor core. It has a 32-bit architecture with a 32-bit address space. In addition, more registers have been added, allowing for a more robust operating system modes.

MICROPROCESSORS

All of the ARM/RISC cores are also available as a standard product. These CPU only packages are ideal for embedded control applications. The CPU only solutions allow for the simplest, and most cost-efficient applications of the ARM/RISC processor, and are well suited for designs which do not require extensive memory management.

The VY86C010 is a basic 12 MHz RISC microprocessor with a 26-bit address space. Its has a 32-bit internal architecture, and supports 27 internal registers.

The VY86C060 is an enhanced 25 MHz RISC microprocessor with 32 bits of address space and JTAG support. Its architecture has been enhanced to support 31 registers and increased modes of operation.

The VY86C061 is an enhanced 25 MHz RISC microprocessor with a 26-bit address bus. It is compatible with the VY86C010 and packaged identically. This product is offered as a migration path from the ARM2aS to the ARM6 processor family.

ENHANCED MICROPROCESSORS

To provide increased flexibility and performance to our customers, we have combined commonly used modules, such as cache and memory management, with our CPU cores and have packaged them together. This allows for board designs with a minimum chip count, and are ideally suited for applications where a MMU might otherwise be used.

In order to improve the performance of the VY86C010 CPU and still allow the use of standard DRAMs, the VY86C020 is an improved version of the VY86C010 that operates at 25 MHz and includes 4K bytes of fast cache integrated on chip. The VY86C020 is a natural upgrade for systems developed for the VY86C010, effecting a 2 to 3 times improvement in performance.

Finally, the VY86C600 features an enhanced CPU running at 20 MHz with integrated 4K byte cache, memory management and JTAG support, designed for modern operating systems and object-based coding.

SUPPORT CHIPS

To assist designers in the most common of applications, several support chips have been developed.

The basic ARM/RISC CPU (VY86C010) is supported by three support devices:

- VY86C110 Memory Controller
- VY86C310 Video/ Sound Output Chip
- VY86C410 I/O and Interrupt Controller

These support chips complement the VY86C010 in building a cost effective, high-performance personal computer.

PRODUCT OFFERING

Product Type	Product Family		
FSB		ARM2aS	ARM6
CPU	VY86C010		VY86C060 VY86C061
Expanded CPU		VY86C020	VY86C600
Support Chips:			
Memory Controller	VY86C110		
Video/Sound Output	VY86C310		
I/O & Interrupt Controller	VY86C410		

VLSI Technology

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32-BIT PROCESSOR FAMILY FUNCTIONAL SYSTEM BLOCKS (FSB)

FEATURES

- Fully static operation
- Configured as an FSB for ASIC applications
- 32-bit data bus
- 26- or 32-bit address bus
- Support for virtual memory systems
- Simple but powerful instruction set
- Coprocessor interface for instruction set extension
- Maximum clock frequency of 25 MHz, yielding a 25 MIPs peak and 14 MIPs sustained execution rate (ARM6)
- Maximum clock frequency of 20 MHz, yielding an 11 MIPs sustained execution rate (ARM2aS)
- Fast interrupt response for real-time applications
- Low power consumption with a single +5 V supply
- Core size 160 x 110 mils (ARM6)
- Core size 130 x 110 mils (ARM2aS)

DESCRIPTION

The ARM2aS FSB has a 26-bit address bus, with 27 32-bit registers arranged in partially overlapping sets. There are 16 directly addressable registers in each set. All instructions are 32-bits long, and pipelining is employed so that all parts of the processing and memory systems can operate continuously. Typically, while one instruction is being executed, its successor is being decoded, and a third instruction is being fetched from memory.

The ARM6 FSB is compatible with the instruction set of the ARM2aS. Unlike the ARM2aS which has a 26-bit address bus, the ARM6 has a 32-bit address bus. For backwards compatibility, the ARM6 can be configured to use a 26-bit address bus. The ARM6 has 31 32-bit registers arranged in partially overlapping sets. There are 16 directly addressable registers in each set. All instructions are 32-bits long, and pipelining is employed so that all parts of the processing and memory systems can operate continuously. Typically, while one instruction is being executed, its successor is being decoded, and a third instruction is being fetched from memory.

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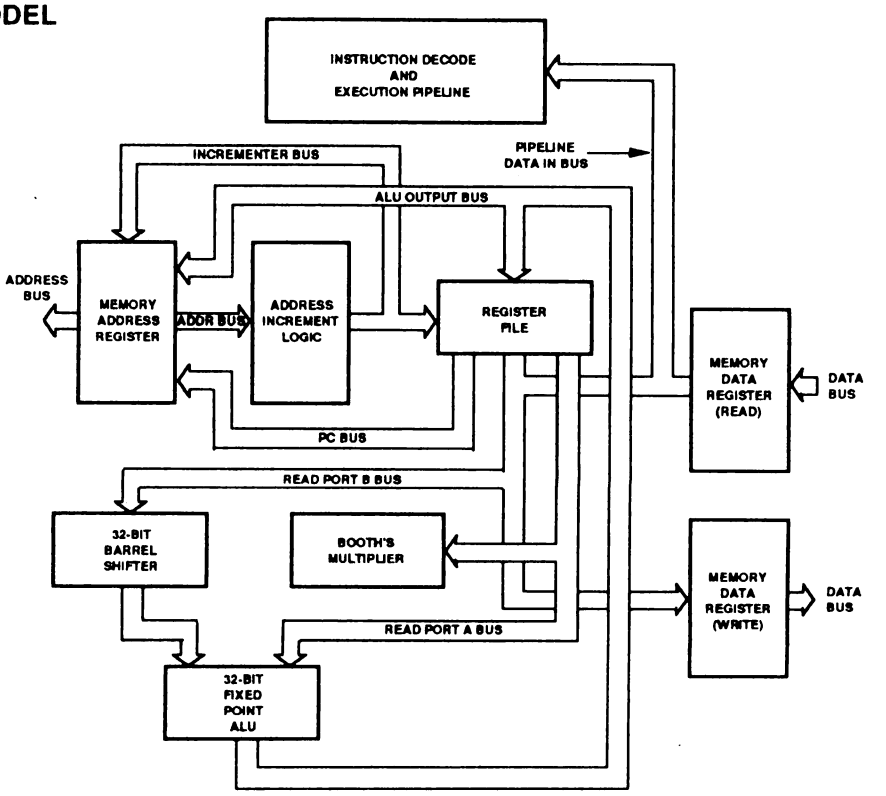
HARDWARE MODEL



VLSI TECHNOLOGY, INC.

LASER PRINTER CHIP SETS

OVERVIEW

Today's office automation technology is revolutionizing data processing and information management literally day by day. Laser printers are one such example where advanced embedded RISC technology has pushed laser printer performance to higher and higher page-per-minute (ppm) levels. The next dimension in laser printers is compact and affordable solutions that do not compromise ppm performance. The solution resides in the hands of state-of-the-art integration that complements the RISC engines used today, and drastically reduces motherboard discrete component use.

VLSI's Laser Printer Chip Set is the industry's first integrated solution that seriously addresses the needs of the embedded laser printer performance, integration, and pricing issues.

Designed in cooperation with Advanced Micro Devices, Inc. to provide compatibility to AMD's current and future RISC core processors, the chip set is used extensively in medium-to-high-end laser printer applications.

The set consists of two chips, the VY86C129 Memory Controller (MEMC29K) and the VY86C429 Laser Printer Interface Chip (LPIC). When used together with the AM290xx, the chips fully implement the AMDLaser29™ board used in embedded laser control applications worldwide.

The LPIC and the MEMC29K are just two examples of the high-performance 1-micron CMOS integrated solutions available to designers of embedded control applications.

VY86C429 (LPIC) FEATURES

- Supports two I/O cycle types (simple and burst mode)
- Wait-request line on the interface to extend cycles
- AppleTalk component interface handshakes
- SCSI component interface handshakes
- Support for two classes of interrupts (14 levels)
- 512-Byte Video FIFO for full scan line buffering
- RS-232 Serial Port with 1200 to 115K baud support
- Bidirectional Parallel port with direct drive
- In-Circuit-Test support logic included
- Packaged in a 144-Pin Plastic Quad Flat Pack

VY86C129 (MEMC29K) FEATURES

- Processor speeds of 16 and 25 MHz supported
- 32-bit DRAM Memory interface
- 32-bit on-board ROM interface

  Two classes of interrupts (high and low priority)
- Supports external I/O cycles with wait handshake
- Burst mode cycle support for external peripherals
- Packaged in a 160-Pin Plastic Quad Flat Pack

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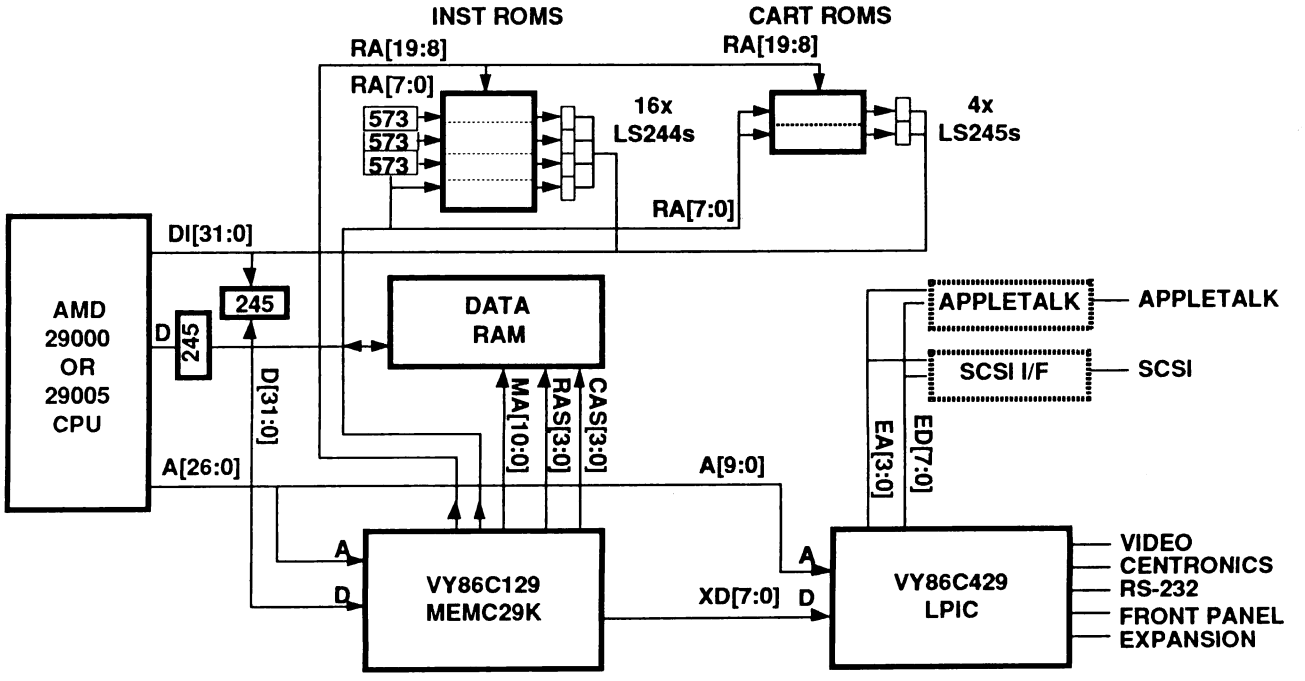
VLSI'S LASER PRINTER CHIP SET



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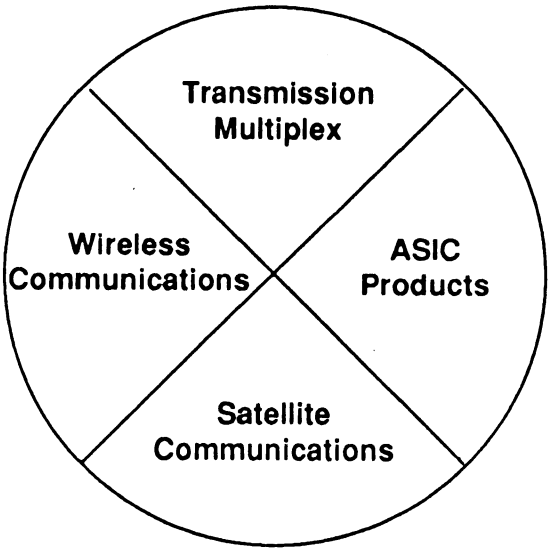

VLSI Technology

TRANSMISSION/MULTIPLEX PRODUCTS

T1 PRODUCTS

- T1 Dual Line Interface (VP14312)
- T1 Dual Performance Monitor (VP14322)
- T1 Transceiver (VP14341)
- T1 Quad Facility Data Link (VP14374)

SONET PRODUCTS

- SONET Section Transceiver (VP15301)
- SONET Line Transceiver (VP15311)
- SONET Triple Payload Processor (VP15323)

E1 PRODUCTS

- E1 Performance Monitor (VP16322)

T3 PRODUCTS

- T3 Dual Framer/Performance Monitor (VP18322)

SATELLITE PRODUCTS

- Programmable Forward Error Correction (VP17018)

ASIC PRODUCTS

- Standard Cell Libraries
- Gate Array Libraries
- Functional Compiler Elements
  - Datapath, Memory, Multiplier, etc
- Telecom System Block (TSB) Libraries
  - T1, E1, T3, SONET
- Functional System Block (FSB) Libraries
  - Digital Cellular, Cordless Phone, Core Microprocessor

WIRELESS PRODUCTS

- GSM Vocoder
- GSM Equalizer
- GSM Channel Codec
- GMSK Modulator
- G.721 ADPCM Transcoder ASSP (VP23010)
- G.721 ADPCM Transcoder FSB (VP23110)
- G.721 ADPCM Codec ASSP (VP23060)
- G.721 ADPCM Codec FSB (VP23140)
- DECT Core
- DECT Handset Chip
- OCTAL G721 Transcoder ASSP (VP23020)
- OCTAL G721 FSB (VP23120)

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VLSI TECHNOLOGY, INC.

VP14341 T1XC

T1 TRANSCEIVER

FEATURES

- Integrates a complete T1 transceiver into a single device with analog circuitry for receiving and transmitting DSX-1 compatible signals and digital circuitry for terminating the duplex DS-1 signal
- Recovers clock and data
- Supports B8ZS or AMI line code and gapped data streams to support higher rate multiplexing
- Provides frame synchronization and frame generation for SF, ESF, T1DM (DDS), and SLC®-96 DS1 signals
- Generates AIS and yellow alarm in all formats
- Detects and inserts programmable in-band loopback codes
- Supports line and path performance monitoring according to Bellcore, AT&T and ANSI recommendations
- Extracts and inserts the D-channel for primary rate interfaces
- Extracts and inserts data link in ESF, T1DM and SLC-96 formats
- Provides loss of signal, red alarm, yellow alarm and AIS alarm indication
- Detects violations of the ANSI T1.403 12.5% pulse density rule
- Detects and inserts ESF bit-oriented codes
- Provides an HDLC/LAPD interface for terminating the ESF data link
- Has a two-frame elastic store buffer for jitter and wander attenuation that performs controlled slips and indicates slip occurrence and direction
- Supports transfer of PCM and signalling data to or from a 1.544 Mbit per second or 2.048 Mbit per second backplane bus
- Ensures minimum ones density through Bell (bit 7), GTE or DDS zero code suppression on a per channel basis
- Provides signalling insertion and extraction, idle code substitution, digital milliwatt code substitution, and data inversion on a per channel basis
- Has an 8-bit microprocessor bus interface for configuration, control, and status monitoring
- Low-power CMOS technology
- 68-lead PLCC package

DESCRIPTION

The VP14341 T1 Transceiver (T1XC) is a monolithic integrated circuit that supports T1 transceiver functions for a 1.544 Mbit per second data stream.

The T1XC provides serial PCM interfaces that allow 1.544 Mbit per second or 2.048 Mbit per second backplanes to be directly supported. Tolerance of gapped clocks allow other backplane rates to be supported with a minimum of external logic.

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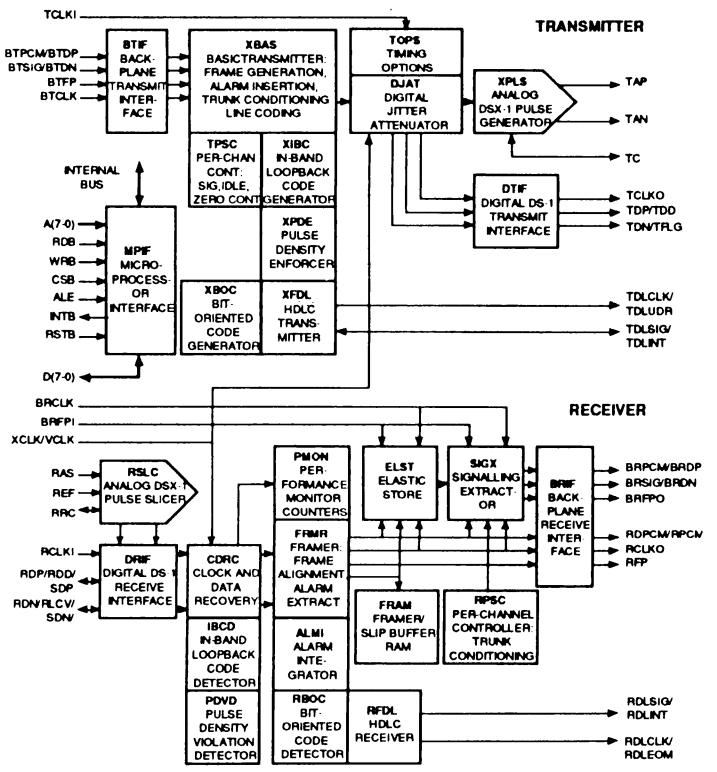
BLOCK DIAGRAM



APPLICATIONS

- T1 Channel Service Units (CSUs)
- T1 Data Service Units (DSUs)
- T1 Channel Banks
- T1 and T3 Multiplexers (CPE MUX)
- Digital Private Branch Exchanges (DPBX)
- Digital Access and Cross-Connect Systems (DACS)
- Electronic Digital Cross-Connect Systems (EDSX)
- T1 and T3 Test Equipment
- ISDN Primary Rate Interfaces (PRI)
- SONET Add-Drop Multiplexers (ADM)

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VLSI TECHNOLOGY, INC.

VP15323 TSPP

TRIPLE SONET STS PAYLOAD PROCESSOR

FEATURES

- Integrates three SONET STS-1 payload processors in a single monolithic device
- Provides payload processing for three independent STS-1 streams or one STS-3 or STS-3c stream
- Provides support for payload processing of higher rate concatenated streams such as STS-12c
- Processes the STS payload pointer(s) to frame align the transport overhead(s)
- Performs frequency justification on the STS stream(s) by modifying the outgoing payload pointer(s)
- Detects loss of pointer (LOP) in the STS-1/3/3c stream(s)
- Inserts STS-path AIS in the STS-1/3/3c stream(s)
- Has the capability to corrupt STS payload pointer(s) for diagnostic purposes
- Low-power CMOS technology
- 84-lead PLCC package

DESCRIPTION

The VP15323 TSPP Triple SONET STS Payload Processor is a monolithic integrated circuit that integrates three independent STS payload processors.

The TSPP processes the payload pointers contained in three independent bit-serial STS-1 streams, one byte-serial STS-3 stream, or one byte-serial STS-3c stream. Four TSPPs may be connected to provide payload processing for a byte-serial STS-12c stream.

The TSPP is used in applications requiring STS frame alignment and frequency justification. Each payload processor contains an STS pointer interpreter, an STS pointer generator and an integral FIFO buffer for payload alignment.

The incoming STS payload pointer is interpreted to locate the start of the synchronous payload envelope (SPE). The SPE is passed through the FIFO, and a new pointer value is generated based on the offset between the outgoing STS frame alignment, and the start of the SPE. Pointer adjustments are inserted in the outgoing STS stream as required to keep the FIFO from overflowing or underflowing.

Loss of pointer (LOP) is detected as part of the pointer interpretation process. STS path AIS is passed transparently through the payload processor, or may be inserted in the outgoing stream(s). The outgoing payload pointer value(s) may be corrupted for diagnostic purposes.

The TSPP is configured, controlled, and monitored using registers that are accessed via a generic 8-bit microprocessor interface.

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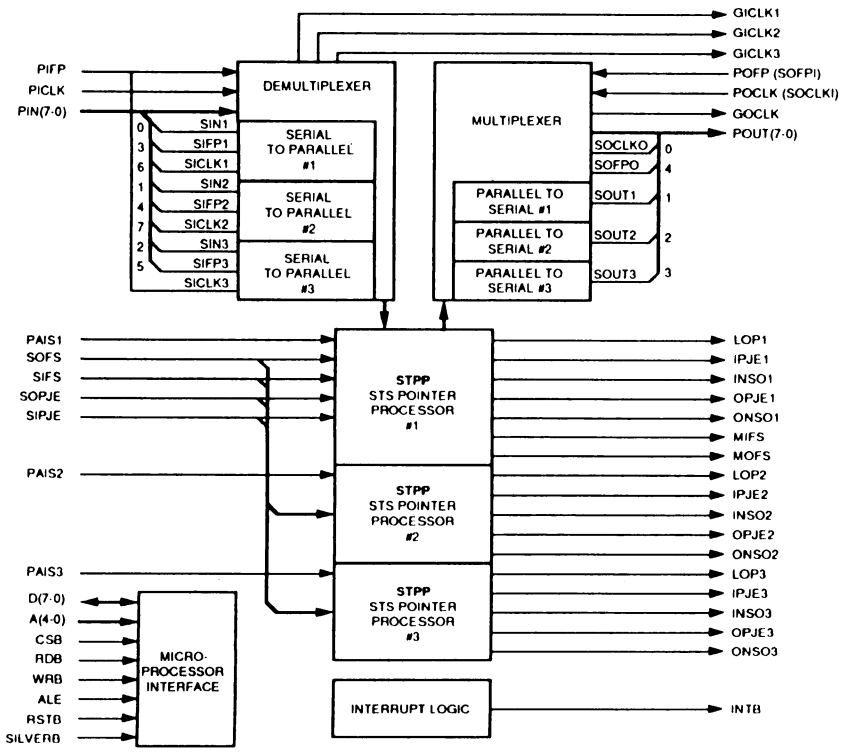
BLOCK DIAGRAM



APPLICATIONS

- OC-N to OC-M Multiplexers
- SONET Terminal Multiplexers
- SONET Add/Drop Multiplexers (ADM)
- SONET Digital Access and Cross-Connect Systems (DACS)
- Test Equipment

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VLSI TECHNOLOGY, INC.

VP23010 G721

G.721 TRANSCODER

FEATURES

- Fully compliant with CCITT Blue Book (Melbourne 1988)
- Low power consumption: 35 mW typical, 50 mW max. at 5 V; 10 mW typical, 15 mW max. at 3 V
- Group delay only 125 µs
- Single supply
- A-law and uniform PCM interface
- Muting control
- Power-down mode during reset
- Side tone generation
- 1-micron CMOS technology
- 28-pin PLCC or SOG package

DESCRIPTION

The VP23010 G.721 is a low power implementation of the CCITT G.721 Blue Book transcoder. G.721 specified originally as a means of increasing the capacity of 64 KBits PCM (Pulse Code Modulation) voice channels by reducing the data rate requirements to 32 KBits ADPCM (Adaptive Differential PCM), has since found wide application in cordless telephone systems such as CT2 and DECT.

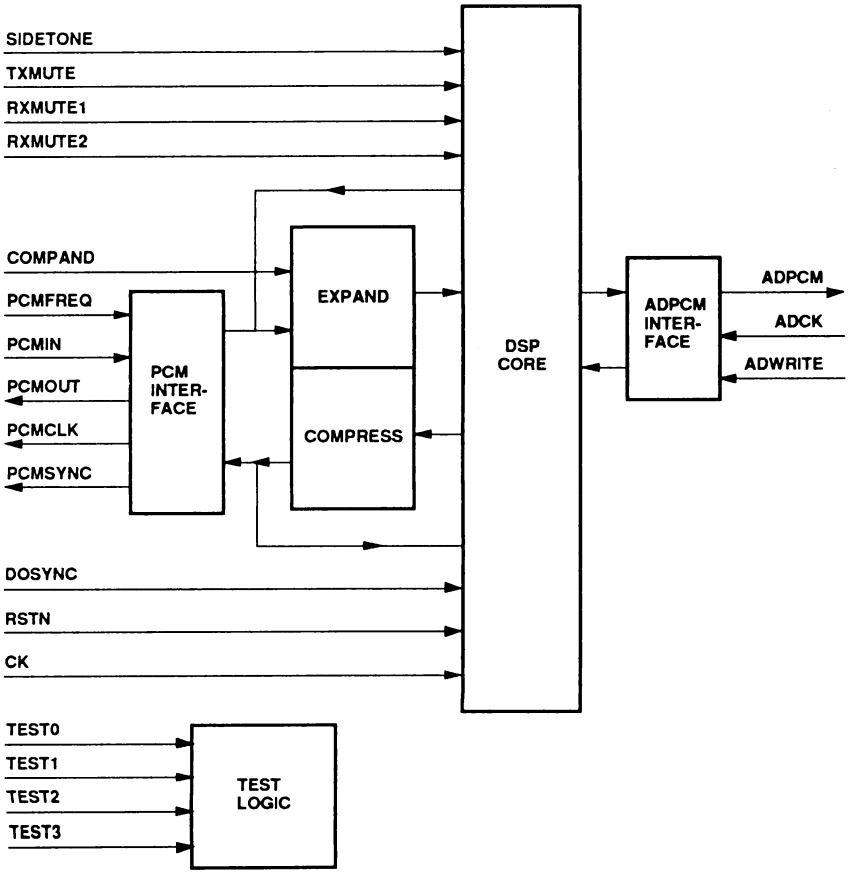
The VP23010 has standard serial data interfaces and its PCM interface connects directly to standard codecs using either companded (A-law) or 13 bit uniform quantised data formats.

The VP23010 has been designed to meet the stringent requirements of cordless telephones as well as the requirements for low rate encoding in telecommunication systems. Its low power consumption, wide power supply range and low group delay are especially important in handset applications.

Additional features such as muting and side tone are particularly useful to the cordless telephone system designer.

The G.721 transcoder is also available as an ASIC cell which includes µ-law companding and other features.

BLOCK DIAGRAM



APPLICATIONS

- Cordless telephone systems: CT2 and DECT
- Voice store and forward
- Channels signalling equipment (2048 KBits and 1544 KBits)
- For Base Station systems, refer to VP23020 OCTAL G721 data sheet

VLSI Technology

PROGRAMMABLE PERIPHERALS

SINGLE-CHIP CMOS USER-CONFIGURABLE PERIPHERAL WITH MEMORY – COMMERCIAL & MILITARY

Part No.	Description	Speed (ns) Comm'l	Speed (ns) Military	Availability Samples	Availability Prodn	Package Selection J	L	Q	X
PSD301	Programmable Microcontroller Peripherals with Memory; x8/x16; 256Kb – 1Mb EPROM; 16K SRAM; PAD; System Features.	120		NOW	Q4 '91	•	•	•	
		150-200		NOW	NOW	•	•	•	•
			200		NOW		•		•
PSD311		120		NOW	Q4 '91	•	•	•	
		150-200		NOW	Q4 '91	•	•	•	•
			200		Q4 '91		•		•
PSD302		120		NOW	Q1 '92	•	•		
		150-200		NOW	Q1 '92	•	•		
PSD312		120		NOW	Q1 '92	•	•		
		150-200		NOW	Q1 '92	•	•		
PSD303		120		Q4 '91	Q1 '92				
		150-200		Q4 '91	Q1 '92				
PSD313		120		Q4 '91	Q1 '92				
		150-200		Q4 '91	Q1 '92				
MAP168	DSP Peripheral with Memory. Features: 128K Bits EPROM, 32K Bits SRAM Programmable Address Decoder (PAD) Configurable: x8 or x16.	45-55		NOW	NOW	•	•	•	•
			55		NOW	•		•	

HIGH-PERFORMANCE CMOS USER-CONFIGURABLE EMBEDDED CONTROLLER – COMMERCIAL & MILITARY

Part No.	Description	Speed (ns) Comm'l	Speed (ns) Military	Availability Samples	Availability Prodn	Package Selection Q	X
PAC1000	High-Speed User-Configurable Embedded Controller, Optimized for High-Performance Control Systems. Key Features Include: 16-Bit CPU, 16-Bit Address Port, 16-Bit Output Control, 8-Bit I/O Port and Configuration Registers.	12MHz		NOW	NOW	•	•
			12MHz	NOW	NOW		•
		16MHz		NOW	NOW	•	•

HIGH-PERFORMANCE CMOS USER-CONFIGURABLE MICROSEQUENCER/STATE MACHINE – COMMERCIAL & MILITARY

Part No.	Description	Speed (ns) Comm'l	Speed (ns) Military	Availability Samples	Availability Prodn	Package Selection J	L	S	T
SAM448	User-Programmable Microsequencer for Implementing High-Performance State Machines. Includes EPROM integrated with Branch Control Logic, Pipeline Register, Stack and Loop Counter and 768 Product Terms.	20-25MHz		NOW	NOW	*	•	*	•
			20MHz	NOW	NOW		•		•

*J and S packages not available in 30MHz

SOFTWARE DEVELOPMENT TOOLS †

Part No.	Includes	Availability
PSD - GOLD	Contains PSD301/MAP168 Software, Users Manual, WS6000 MagicPro (PC Based Programmer), Package Adapter and 2 Sample Devices	NOW
PSD - SILVER	Contains PSD301/MAP168 Software and Users Manual	NOW
PAC1000 - GOLD	Contains PAC1000 Software, Users Manual, WS6000 MagicPro (PC Based Programmer), Package Adapter and 2 Sample Devices	NOW
PAC1000 - SILVER	Contains PAC1000 Software and Users Manual	NOW
SAM448 - GOLD	Contains SAM448 Software, Users Manual, WS6000 MagicPro (PC Based Programmer), WS6008(T) or 6009(C,J,L) Adapter and 2 Sample Devices	NOW
SAM448 - SILVER	Contains SAM448 Software and Users Manual	NOW
MEMORY - SILVER††	Contains WSI EPROM/RPROM Programming Software and Users Manual	NOW

† 1) All Development Systems include: 12 Month Software Update Service, access to WSI's 24 Hour Electronic Bulletin Board.
2) Package adaptor must be specified when ordering any "Gold" system.

†† 1) Memory-Silver is included in all development systems.

NON-VOLATILE MEMORY

CMOS PROMs – COMMERCIAL

Part No.	Architecture	Description	Speed (ns)	Package Selection D	J	L	P	S	T
WS57C191B	2K x 8	16K CMOS PROM	35-55	•	•		•		
WS57C291B	2K x 8	16K CMOS PROM	35-55					•	•
WS57C45	2K x 8	16K CMOS Reg. PROM	25-35					•	•
WS57C43B	4K x 8	32K CMOS PROM	35-70	•	•			•	•
WS57C49B	8K x 8	64K CMOS PROM	35-70	•	•			•	•
WS57C51C	16K x 8	128K CMOS PROM	35-70	•	•	•			•
WS57C71C	32K x 8	256K CMOS PROM	45-70	•	•	•			•

CMOS PROMs – MILITARY

Part No.	Architecture	Description	Speed (ns)	DESC SMD	Package Selection C	D	F	H	K	T	Z
WS57C191B	2K x 8	16K CMOS PROM	45-55	•	•	•	•				•
WS57C291B	2K x 8	16K CMOS PROM	45-55	•					•	•	
WS57C45	2K x 8	16K CMOS Reg. PROM	35-45	•	•		•	•	•	•	
WS57C43B	4K x 8	32K CMOS PROM	45-70		•					•	
WS57C49B	8K x 8	64K CMOS PROM	45-70	•	•	•	•			•	
WS57C51C	16K x 8	128K CMOS PROM	45-70		•	•				•	
WS57C71C	32K x 8	256K CMOS PROM	55-70		•	•				•	

NON-VOLATILE MEMORY (Cont.)

HIGH-SPEED CMOS EPROMs – COMMERCIAL

Part No.	Architecture	Description	Speed (ns)	Package Selection D	J	L	T
WS57C64F	8K x 8	High-Speed 64K CMOS EPROM	55-70	•	•		
WS57C128F	16K x 8	High-Speed 128K CMOS EPROM	55-70	•			
WS57C128FB	16K x 8	High-Speed 128K CMOS EPROM	35-45	•	•	•	
WS57C256F	32K x 8	High-Speed 256K CMOS EPROM	45-70	•	•	•	•

HIGH-SPEED CMOS EPROMs – MILITARY

Part No.	Architecture	Description	Speed (ns)	DESC SMD	Package Selection C	D	T	L
WS57C64F	8K x 8	High-Speed 64K CMOS EPROM	70	•	•	•		
WS27C64F	8K x 8	Low-Power 64K CMOS EPROM	90	•	•	•		
WS57C128F	16K x 8	High-Speed 128K CMOS EPROM	70	•	•	•		
WS57C128FB	16K x 8	High-Speed 128K CMOS EPROM	45-55		•	•		
WS27C128F	16K x 8	Low-Power 128K CMOS EPROM	90	•	•	•		
WS57C256F	32K x 8	High-Speed 256K CMOS EPROM	55-70	•	•	•	•	
WS27C256F	32K x 8	Low-Power 256K CMOS EPROM	90	•	•	•		•

CMOS EPROMs – COMMERCIAL

Part No.	Architecture	Description	Speed (ns)	Package Selection D	J	L
WS27C010L	128K x 8	Low-Power 1 Meg CMOS EPROM	120-150	•	•	•
WS27C210L	64K x 16	Low-Power 1 Meg CMOS EPROM	100-200	•	•	•

CMOS EPROMs – MILITARY

Part No.	Architecture	Description	Speed (ns)	DESC SMD	Package Selection C	D	L	T
WS27C64L	8K x 8	Low-Power 64K CMOS EPROM	120-350	•	•	•		
WS27C128L	16K x 8	Low-Power 128K CMOS EPROM	120-300	•	•	•		
WS27C256L	32K x 8	Low-Power 256K CMOS EPROM	120-250	•	•	•		•
WS27C512L	64K x 8	Low-Power 512K CMOS EPROM	120-200	•	•	•		•
WS27C010L	128K x 8	Low-Power 1 Meg CMOS EPROM	150-200	•	•	•	•	
WS27C210L	64K x 16	Low-Power 1 Meg CMOS EPROM	150-200		•	•	•	

CMOS BIT SLICE AND LOGIC

Part No.	Description	Speed		Package Selection							
		Comm'l	Military	B	G	J	K	L	P	S	Y
WS5901	4-Bit CMOS Bit Slice Processor	32,43 MHz	32,43MHz						•		•
WS59016	16-Bit CMOS Bit Slice Processor	15 MHz	12.5MHz	•		•		•			
WS59032	32-Bit CMOS Bit Slice Processor	26.4,33 MHz	23.6,29 MHz		•						
WS5910	CMOS Microprogram Controller	20,30 MHz	20,30 MHz						•		•
WS59510	16K x 16 CMOS Multiplier-Accum.	30-50 ns			•	•			•		
WS59520	CMOS Pipeline Register	Tpd = 22ns	Tpd = 24ns				•			•	
WS59521	CMOS Pipeline Register	Tpd = 22ns	Tpd = 24ns				•			•	
WS59820	CMOS Bi-Directional Register	Tpd = 23ns	Tpd = 25ns		•	•					

WSI PACKAGE DESCRIPTIONS

Package Code	Description	Window	Surface Mount	Plastic/OTP
B/R	Ceramic Sidebrazed Dip	N/Y	N	–
C	Ceramic Leadess Chip Carrier (CLLCC)	Y	Y	–
C/Z	Ceramic Leadless Chip Carrier (CLLCC)	Y/N	Y	–
D/Y	0.600" Ceramic Dip	Y/N	N	–
F/H	Ceramic Flatpack	Y/N	Y	–
J	Plastic Leaded Chip Carrier (PLDCC)	N	Y	Y
L/N	Ceramic Leaded Chip Carrier (CLDCC)	Y/N	Y	–
P	Plastic Dip	N	N	Y
Q	Plastic Quad Flat Pack (PQFP)	N	Y	Y
S	0.300" Plastic Dip	N	N	Y
T/K	0.300" Ceramic Dip	Y/N	N	–
X/G	Ceramic Pin Grid Array (CPGA)	Y/N	N	–

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USA Mid-Atlantic:	Tel: 215-638-9617	Fax: 215-638-7326
USA Northeast:	Tel: 508-685-6101	Fax: 508-685-6105
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Printed in U.S.A. 10/91
Revision 8.2

THE WESTERN DESIGN CENTER, INC.

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William D. Mensch, Jr. founded The Western Design Center, Inc. (WDC), in Mesa, Arizona in 1978. The company designs, licenses, and sells microprocessors and microcomputers. WDC is known primarily for its W65C product line, which includes enhanced CMOS versions of the 6502 microprocessor. Instead of working with a single foundry, WDC works with foundries all over the world to provide its customers with the most advanced technology available.

The Standard Chip Products

The Western Design Center has three standard microprocessors, three standard microcomputer products, and several peripheral chips. All of these parts are based on an economical, yet powerful 8-bit data bus.

The W65C02 8-bit microprocessor, and enhanced CMOS version of the original NMOS 6502, is plug compatible with NMOS part and runs all existing software. Aside from adding new instructions to the 6502, the CMOS design allows the W65CO2 to be used in low power applications. Available in a 40-pin plastic DIP, 44-lead PLCC, surface mount packaging or as die.

The W65C816-16-bit microprocessor maintains full software compatibility with the 6502 and W65CO2 wile adding new 16-bit registers and new instructions. Among the new features added to the W65C816 are a 16-bit stack pointer and a 24-bit (16M byte) linear address space. Available in a 40-pin plastic DIP, 44-lead PLCC, surface mount packaging or as die. The W65C802 is a W65C816 that is plug compatible with the 6502.

The W65C832 32-bit microprocessor maintains full compatibility with the W65C816 and W65C02 while extending the index registers and the accumulator to 32-bits and adding more high level language and math instructions. The W65C832 plugs into a W65C816 PLCC socket.

The W65C134 8-bit microcomputer is built around a static W65C02 core with on-chip RAM, mask ROM, timers, I/O ports, and asynchronous serial port (UART), and low-power modes. The W65C265 16-bit microcomputer has a static W65C816 core and includes many of the same features as the W65C134. Similarly, the W65C365 microcomputer has a W65C832 core.

WDC's W65C peripherals include the W65C22 (a CMOS version of the NMOS 6522), the W65C29 (a programmable 8-bit port), and the W65C90 (a programmable 8-bit comparator).

For detailed information about W65C products, please refer to the data sheets for each product. Samples are available for all products. The W65C265, W65C832 and W65C365 samples will be available after development and qualification is complete.

Western Design Center

The Licensing Process

The Western Design Center has licensed its core microprocessors and microcomputers to companies throughout the world. WDC offers several unique approaches to licensing.

The first approach to licensing is called a ***standard product license.*** In this approach, companies who require large volumes or application specific processing, such as medical implantable grade of WDC standard products can buy finished goods directly from one of several foundries. The licensees pay WDC a per-chip royalty, working directly with the factory provides the licensee greater control over pricing and scheduling.

The second licensing approach, called ***single-use core license,*** allows a company to cost-reduce a microprocessor-based system into a single Application Specific Processor (ASP) or into an ASP plus few chips. The core licensee can design an ASP around one of WDC's W65C core products.The licensee pays a license fee and a per-chip royalty. WDC works with companies who can provide ASP design and foundry services to the licensee.

The third approach is a ***multiple-use core license.*** With this approach, companies receive the most flexibility in using W65C cores.As with the other licensing approaches, the licensee pays WDC a license fee and a royalty. Normally, semiconductor or large systems companies who have design expertise take out multiple-use core licenses.

WDC's microprocessor and microcomputer cores are CMOS, single layer poly, double layer metal designs that can be run on N-well, P-well or Twin-well processes. WDC's design rules allow the core layouts to be scaled to run on any process with geometries from 3.0 microns down to 0.5 microns.

All of WDC's cores are registered with the United States Patent and Copyright Office. These patents, maskworks, and copyrights protect not only WDC's interests but also its licensees' interests.

Microprocessors

W65C02 - *CMOS 8-bit Microprocessor*

The W65C02 has 66 instructions, 180 operational codes, and 15 addressing modes with one 8-bit accumulator, two 8-bit index registers, and an 8-bit stack pointer (256 byte stack). The standard part has an 8-bit data bus and a 16-bit address bus (64K byte address space) and comes in a 40-pin plastic DIP package or a 44-lead PLCC package. Currently, parts that run at clock rates up to 10 MHZ are available. The clock input is not divided internally; the memory bus runs at one clock cycle per memory cycle. The 40-pin DIP is plug compatible with and a direct replacement for the NMOS 6502 microprocessor used in early Apple, Atari, and Commodore computers.

W65C816 - *CMOS 16-bit Microprocessor*

The W65C816 has 91 instructions, 255 operational codes, and 24 addressing modes with one 16-bit accumulator, two 16-bit index registers, and a 16-bit stack pointer (64K byte stack). The standard part has an 8-bit data bus and a 24-bit address bus (16M byte address space) and comes in a 40-pin plastic DIP package or a 44-lead PLCC package. Currently, parts that run at clock rates up to 10 MHZ are available. The clock input is not divided internally; the memory bus runs at one clock cycle per memory cycle. The W65C816 has a software-switchable emulation mode that allows it to run all 6502 and 65Co2 software without modification.

W65C802 - *CMOS 16-bit Microprocessor*

This part is a W65C816 that is plug compatible with and a direct replacement for the 6502 and the 65C02; the W65C802 can therefore add W65C816 instructions to an existing 6502 system with no hardware modifications. All internal instructions and registers are identical to those on the W65C816, but the part can address only 64K bytes of memory externally.

W65C832-*CMOS 32-bit Microprocessor **

The 32-bit W65C832 is software compatible with both the W65C816 while adding a 32-bit accumulator and two 32-bit index registers. Software compatibility with the W65C02 is also maintained.The W65C832 is pin compatible with the W65C816 PLCC packages and acts as a direct replacement in existing systems.

Microcomputers

W65C134 - *CMOS 8-bit Microcomputer*

The W65C134 has a W65C02S core microprocessor that is a fully static version of the W65C02; the part can run at very low clock frequencies for low power operation. The W65C134 has the following functions built on-chip with the microprocessor: 192 byte static RAM, 4K byte mask ROM, seven 8-bit bidirectional I/O ports (56 I/O pins), and four 16-bit timers.The 56 I/O pins can be re-configured in software to provide the following additional functions: external memory bus (8-bit data, 16 bit-address), hardware interrupts (1 NMIM, 2 IRQ, 7 positive edge, 5 negative edge), eight chip select outputs (for external static memories and I/O), a UART, and a serial interface bus (SIB). In addition, the W65C134 has the following features: vectored interrupt system (22 priority encoded interrupts), two clock inputs (software switchable between low frequency and high frequency), wide power supply range (1.2 volts to 5.5 volts), and In-Circuit Emulation (ICE) support on-chip. The standard W65C134 package is a 68 lead PLCC, but other packages are available for ASP applications.

W65C265 - *CMOS 16-bit Microcomputer **

The W65C265 has a W65C816S core microprocessor that is a fully static version of the W65C816; the part can run at very low clock frequencies for low power operation. The W65C265 has the following functions built on-chip with the microprocessor: 576 byte static RAM, 8K byte mask ROM, eight 8-bit bidirectional I/O ports (64 I/O pins), and eight 16-bit timers. The 64 I/O pins can be re-configured in software to provide the following additional functions: external memory bus (8-bit data, 24-bit unmultiplexed address), hardware interrupts (1 NMI or ABORT, 1 IRQ, 1 positive edge, 3 negative edge), eight chip select outputs (for external static memories and I/O), four UARTs, and a parallel interface bus (PIB). In addition, the W65C265 has the following features: vectored interrupt system (29 priority encoded interrupts), two clock inputs (software switchable between low frequency and high frequency), wide power supply range (1.2 volts to 5.5 volts), tone generator (sine wave) outputs, and In-Circuit Emulation (ICE) support on-chip. The standard W65C265 package is an 84 lead PLCC, but other packages are available for ASP applications.

W65C365 - *CMOS 32-bit Microcomputer **

The W65C365 has a W65C832S core microprocessor that is a fully static version of the W65C832; the part can run at very low clock frequencies for low power operation. The W65C365 has the following functions built on-chip with the microprocessor: 576 byte static RAM, 8K byte mask ROM, eight 8-bit bidirectional I/O ports (64 I/O pins), and eight 16-bit timers. The 64 I/O pins can be re-configured in software to provide the following additional functions: external memory bus (8 bit data, 24-bit unmultiplexed address), hardware interrupts (1 NMI or ABORT, 1 IRQ, 1 positive edge, 3 negative edge), eight chip select outputs (for external static memories and I/O), four UARTs, and a parallel interface bus (PIB). In addition, the W65C365 has the following features: vectored interrupt system (29 priority encoded interrupts), two clock inputs (software switchable between low frequency and high frequency), wide power supply range (1.2 volts to 5.5 volts), tone generator (sine wave) outputs, and In-Circuit Emulation (ICE) support on-chip. The standard W65C365 package is an 84 lead PLCC, but other packages are available for ASP application.

*Samples will be available upon development completion.

Peripherals

W65C22 - *CMOS Versatile Interface Adaptor*

The W65C22 Versatile interface Adaptor (VIA) is multifunction I/O device, a direct replacement for the NMOS 6522. The W65C22 has the following features: two 8-bit bidirectional I/O ports, two 16-bit timers, a serial port, interrupting polling/IRQ generation, and handshaking. The part's internal registers occupy 16 byte addresses. The W65C22 is available in a 40-pin plastic DIP package or a 44-lead PLCC package.

W65C29 -*CMOS 8-bit Peripheral Port*

The W65C29 has eight I/O pins that are individually programmable as inputs or outputs. The part has two internal registers, a data register and a data direction register, that occupy two byte addresses. The W65C29 is available in a 300 mil 24-pin plastic DIP package One application of this part is to replace W65C microcomputer I/O ports that are lost when an external memory bus is used.

W65C90 - *CMOS 8-bit Digital Comparator*

This part has eight digital input pins that it compares with internal registers. The W65C90 has three internal registers (occupying two byte addresses): a mask register, a compare register (write-only), and a data register (read-only). Bits in the mask register determine which corresponding bits in the compare register are to be compared with the input pins (i.e. some pins can be "don't care"). When the bit values in the compare register match the input pins, a pin called EQOUTB goes low. Reading the data register reads the input pins themselves. The W65C90 is available in a 300-mil 24-pin plastic DIP package. One application of this part is a breakpoint in a hardware debugger.

(All W65C peripherals have a W65C microprocessor interface with an 8-bit data bus, a R/W pin, and Chip Select Input(s); peripheral addresses are memory mapped into the microprocessor address space.

Advance Information

4K X20C04 512 x 8 Bit

Nonvolatile Static RAM

FEATURES

- 150 ns Access Time
- High Reliability
  - —Endurance: 1,000,000 Store Operations
  - —Retention: 100 Years Minimum
- Power-on Recall
  - —E^2PROM Data Automatically Recalled Into SRAM Upon Power-up
- Lock Out Inadvertent Store Operations
- Low Power CMOS
  - —Standby: 250µA
- Infinite E^2PROM Array Recall, and RAM Read and Write Cycles
- Compatible with X2004
- JEDEC Approved Byte-wide Pinout

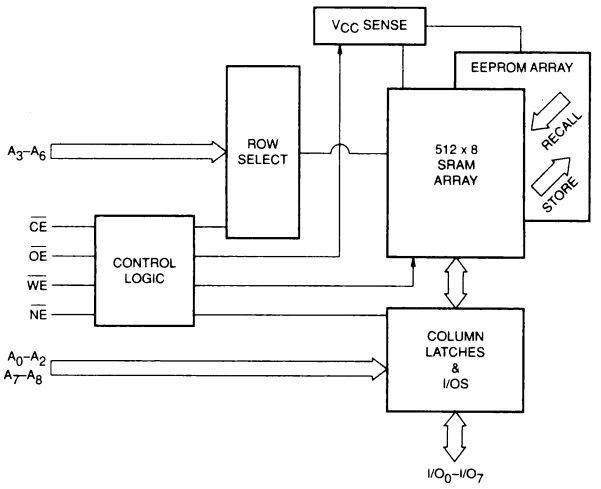
DESCRIPTION

The Xicor X20C04 is a 512 x 8 NOVRAM featuring a static RAM overlaid bit-for-bit with a nonvolatile electrically erasable PROM (E^2PROM). The X20C04 is fabricated with advanced CMOS floating gate technology to achieve low power and wide power-supply margin. The X20C04 features the JEDEC approved pinout for byte-wide memories, compatible with industry standard RAMs, ROMs, EPROMS and E^2PROMs.

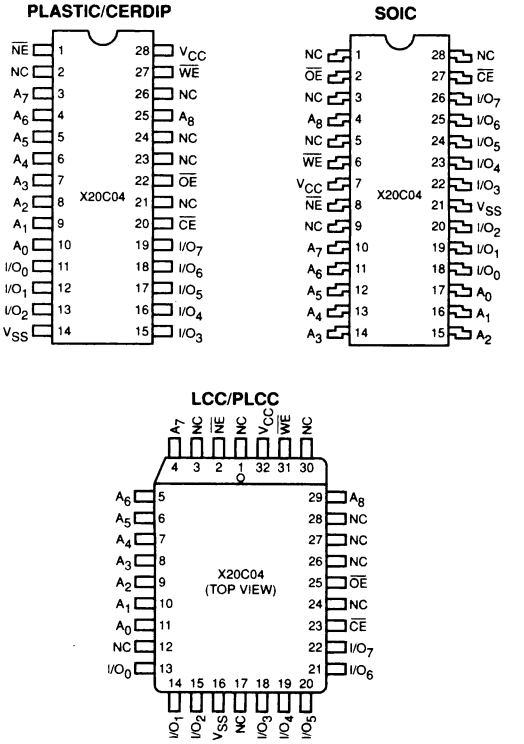
The NOVRAM design allows data to be easily transferred from RAM to E^2PROM (store) and E^2PROM to RAM (recall). The store operation is completed in 5 ms or less and the recall operation is completed in 5 µs or less.

Xicor NOVRAMS are designed for unlimited write operations to RAM, either from the host or recalls from E^2PROM, and a minimum 1,000,000 store operations to the E^2PROM. Data retention is specified to be greater than 100 years.

FUNCTIONAL DIAGRAM



PIN CONFIGURATION



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Characteristics subject to change without notice

Advance Information

4K X20C05 512 x 8

Nonvolatile Static RAM

FEATURES

- Fast Access Time: 35ns, 45ns, 55ns
- High Reliability
  - —Endurance: 1,000,000 Store Operations
  - —Retention: 100 Years Minimum
- Power-on Recall
  - —E^2PROM Data Automatically Recalled Into SRAM Upon Power-up
- AUTOSTORE™
  - —User Enable Option
  - —Automatically Stores SRAM Data Into the E^2PROM Array When V_{CC} Low Threshold is Detected
  - —Open Drain AUTOSTORE™ Status Output Pin
- Software Data Protection
- Lock Out Inadvertent Store Operations
- Low Power CMOS
  - —Standby: 250µA
- Infinite E^2PROM Array Recall, and RAM Read and Write Cycles
- Upward compatible with X20C16 (16K)

DESCRIPTION

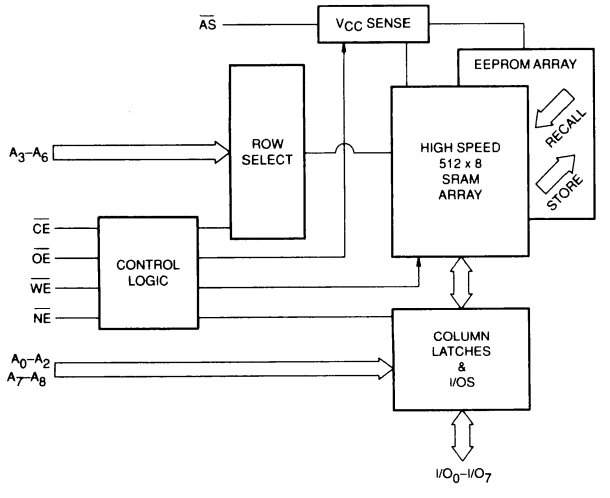
The Xicor X20C05 is a 512 x 8 NOVRAM featuring a high-speed static RAM overlaid bit-for-bit with a non-volatile electrically erasable PROM (E^2PROM). The X20C05 is fabricated with advanced CMOS floating gate technology to achieve high speed with low power and wide power-supply margin. The X20C05 features the JEDEC approved pinout for byte-wide memories, compatible with industry standard RAMs, ROMs, EPROMS and E^2PROMs.

The NOVRAM design allows data to be easily transferred from RAM to E^2PROM (store) and E^2PROM to RAM (recall). The store operation is completed in 5 ms or less and the recall operation is completed in 5 µs or less.

Xicor NOVRAMS are designed for unlimited write operations to RAM, either from the host or recalls from E^2PROM, and a minimum 1,000,000 store operations to the E^2PROM. Data retention is specified to be greater than 100 years.

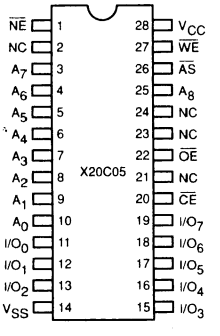
Xicor

FUNCTIONAL DIAGRAM

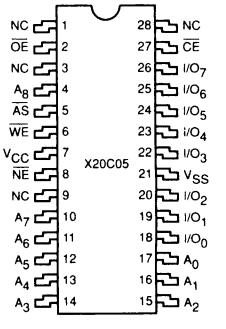


PIN CONFIGURATION

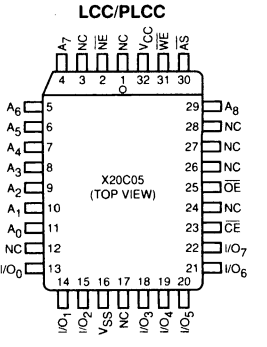
PLASTIC/CERDIP



SOIC



LCC/PLCC



AUTOSTORE™ is a trademark of Xicor, Inc.

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Characteristics subject to change without notice

Advance Information

16K X20C16 2K x 8 Bit

Nonvolatile Static RAM

FEATURES

- Fast Access Time: 35ns, 45ns, 55ns
- High Reliability
  - —Endurance: 1,000,000 Store Operations
  - —Retention: 100 Years Minimum
- Power-on Recall
  - —E^2PROM Data Automatically Recalled Into SRAM Upon Power-up
- AUTOSTORE™
  - —User Enable Option
  - —Automatically Stores SRAM Data Into the E^2PROM Array When V_{CC} Low Threshold is Detected
  - —Open Drain AUTOSTORE™ Status Output Pin
- Software Data Protection
- Lock Out Inadvertent Store Operations
- Low Power CMOS
  - —Standby: 250μA
- Infinite E^2PROM Array Recall, and RAM Read and Write Cycles

DESCRIPTION

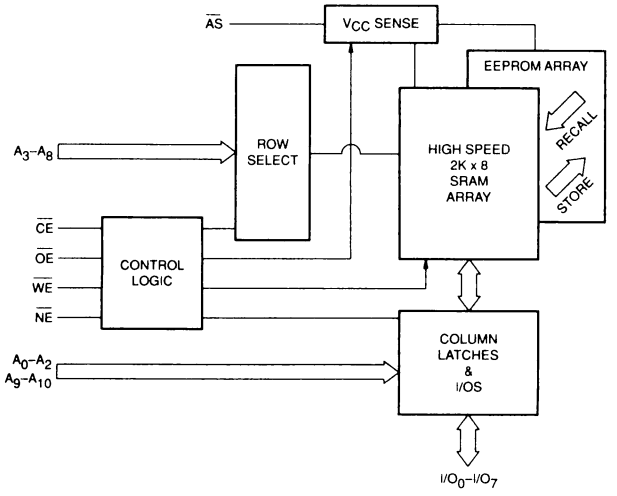
The Xicor X20C16 is a 2K x 8 NOVRAM featuring a high-speed static RAM overlaid bit-for-bit with a nonvolatile electrically erasable PROM (E^2PROM). The X20C16 is fabricated with advanced CMOS floating gate technology to achieve high speed with low power and wide power-supply margin. The X20C16 features the JEDEC approved pinout for byte-wide memories, compatible with industry standard RAMs, ROMs, EPROMS and E^2PROMs.

The NOVRAM design allows data to be easily transferred from RAM to E^2PROM (store) and E^2PROM to RAM (recall). The store operation is completed in 5 ms or less and the recall operation is completed in 10 μs or less.

Xicor NOVRAMS are designed for unlimited write operations to RAM, either from the host or recalls from E^2PROM, and a minimum 1,000,000 store operations to the E^2PROM. Data retention is specified to be greater than 100 years.

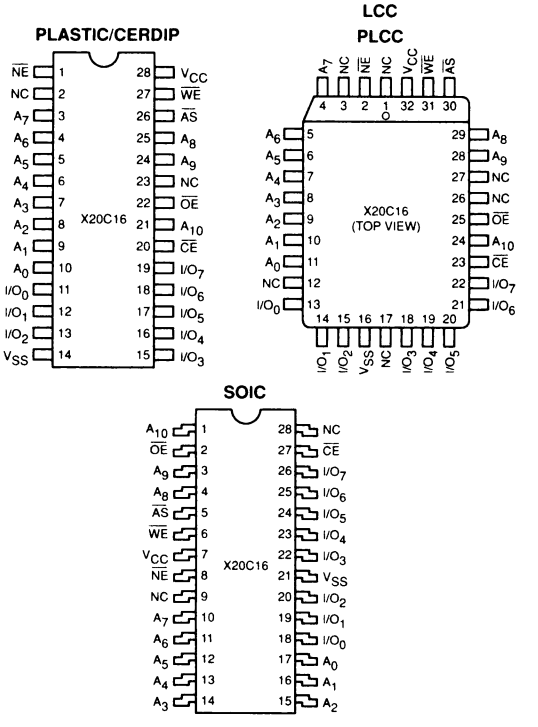
Xicor

FUNCTIONAL DIAGRAM



AutoStore™ is a trademark of Xicor, Inc.

PIN CONFIGURATION



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Characteristics subject to change without notice

16K X2816C 2048 x 8 Bit

Electrically Erasable PROM

FEATURES

- **90 ns Access Time**
- **High Performance Advanced NMOS Technology**
- **Fast Write Cycle Times**
  - **—16-Byte Page Write Operation**
  - **—Byte or Page Write Cycle: 5 ms Typical**
  - **—Complete Memory Rewrite: 640 ms Typical**
  - **—Effective Byte Write Cycle Time: 300 μs Typical**
- **$\overline{\text{DATA}}$ Polling**
  - **—Allows User to Minimize Write Cycle Time**
- **Simple Byte and Page Write**
  - **—Single TTL Level $\overline{\text{WE}}$ Signal**
  - **—Internally Latched Address and Data**
  - **—Automatic Write Timing**
- **JEDEC Approved Byte-Wide Pinout**
- **High Reliability**
  - **—Endurance: 10,000 Cycles**
  - **—Data Retention: 100 Years**

DESCRIPTION

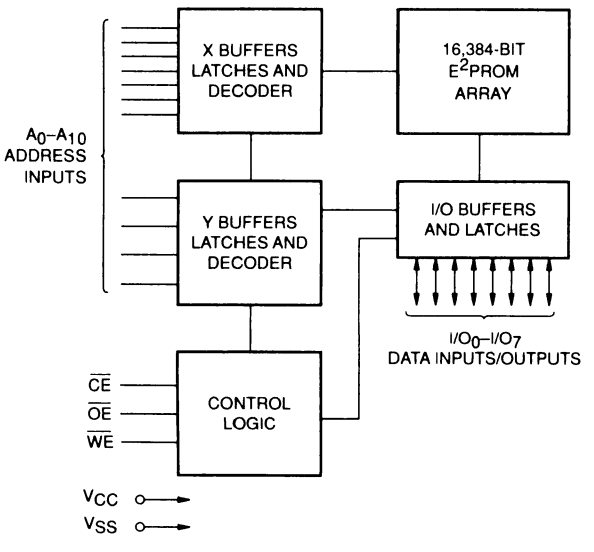
The Xicor X2816C is a 2K x 8 E²PROM, fabricated with an advanced, high performance N-channel floating gate MOS technology. Like all Xicor Programmable nonvolatile memories it is a 5V only device. The X2816C features the JEDEC approved pinout for byte-wide memories, compatible with industry standard RAMs, ROMs and EPROMs.

The X2816C supports a 16-byte page write operation, typically providing a 300 μs/byte write cycle, enabling the entire memory to be written in less than 640 ms. The X2816C also features $\overline{\text{DATA}}$ Polling, a system software support scheme used to indicate the early completion of a write cycle.

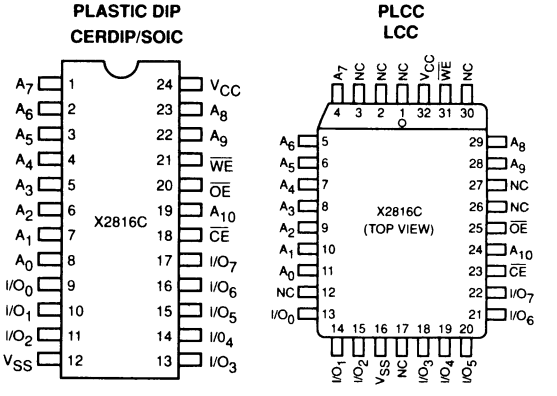
Xicor E²PROMs are designed and tested for applications requiring extended endurance. Inherent data retention is greater than 100 years.

Xicor

FUNCTIONAL DIAGRAM



PIN CONFIGURATION



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Characteristics subject to change without notice

64K X28C64 8K x 8 Bit

Electrically Erasable PROM

FEATURES

- **150 ns Access Time**
- **Low Power CMOS**
  - **—60 mA Active Current Max.**
  - **—200 μA Standby Current Max.**
- **Fast Write Cycle Times**
  - **—64-Byte Page Write Operation**
  - **—Byte or Page Write Cycle: 5 ms Typical**
  - **—Complete Memory Rewrite: 0.625 Sec. Typical**
  - **—Effective Byte Write Cycle Time: 78 μs Typical**
- **Software Data Protection**
- **End of Write Detection**
  - **—$\overline{DATA}$ Polling**
  - **—Toggle Bit**
- **High Reliability**
  - **—Endurance: 10,000 Cycles**
  - **—Data Retention: 100 Years**
- **Simple Byte and Page Write**
  - **—Single TTL Compatible $\overline{WE}$ Signal**
  - **—Internally Latched Address and Data**
  - **—Automatic Write Timing**
- **JEDEC Approved Byte-Wide Pinout**

DESCRIPTION

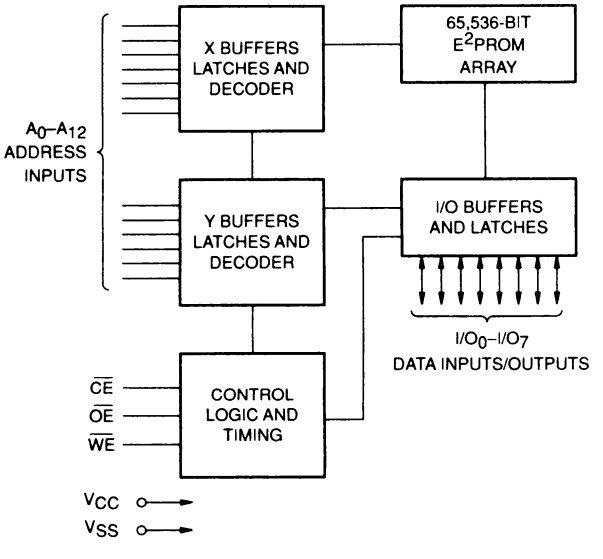
The X28C64 is an 8K x 8 E²PROM, fabricated with Xicor's proprietary, high performance, floating gate CMOS technology. Like all Xicor programmable non-volatile memories the X28C64 is a 5V only device. The X28C64 features the JEDEC approved pinout for byte-wide memories, compatible with industry standard RAMs.

The X28C64 supports a 64-byte page write operation, effectively providing a 78 μs/byte write cycle and enabling the entire memory to be typically written in 0.625 seconds. The X28C64 also features $\overline{DATA}$ and Toggle Bit Polling, a system software support scheme used to indicate the early completion of a write cycle. In addition, the X28C64 includes a user-optional software data protection mode that further enhances Xicor's hardware write protect capability.

Xicor E²PROMs are designed and tested for applications requiring extended endurance. Inherent data retention is greater than 100 years.

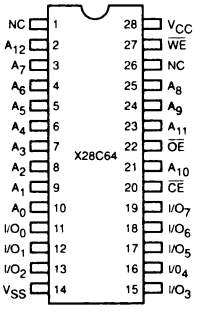
Xicor

FUNCTIONAL DIAGRAM

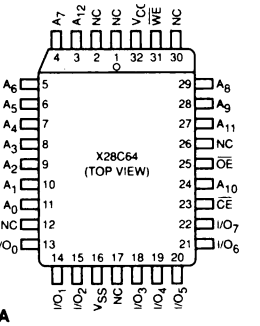


PIN CONFIGURATION

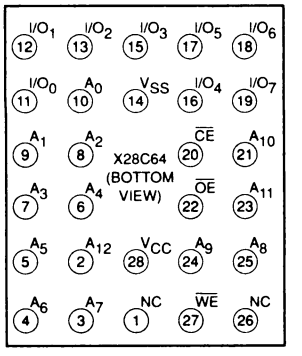
PLASTIC DIP/CERDIP FLAT PACK/SOIC



LCC PLCC



PGA



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Characteristics subject to change without notice

Advance Information

64K X28HC64 8K x 8 Bit

Electrically Erasable PROM

FEATURES

- 60 ns Access Time
- Low Power CMOS
  - —40 mA Active Current Max.
  - —200 µA Standby Current Max.
- Fast Write Cycle Times
  - —64-Byte Page Write Operation
  - —Byte or Page Write Cycle: 2 ms Typical
  - —Complete Memory Rewrite: 0.25 Sec. Typical
  - —Effective Byte Write Cycle Time: 32 µs Typical
- Software Data Protection
- End of Write Detection
  - —$\overline{\text{DATA}}$ Polling
  - —Toggle Bit
- High Reliability
  - —Endurance: 10,000 Cycles
  - —Data Retention: 100 Years
- Simple Byte and Page Write
  - —Single TTL Compatible $\overline{\text{WE}}$ Signal
  - —Internally Latched Address and Data
  - —Automatic Write Timing
- JEDEC Approved Byte-Wide Pinout

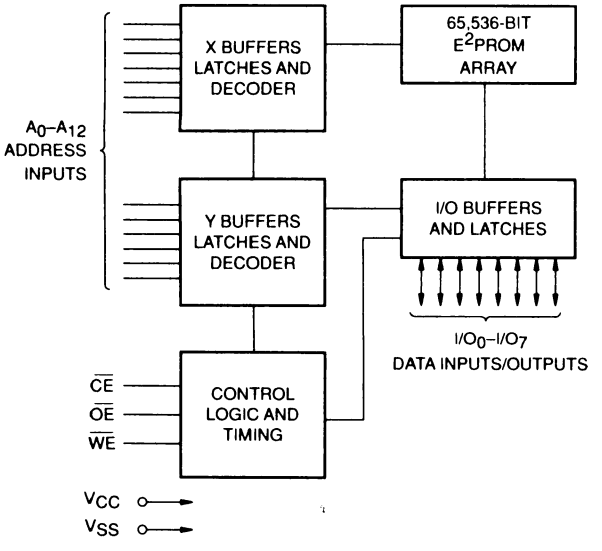
DESCRIPTION

The X28HC64 is an 8K x 8 E²PROM, fabricated with Xicor's proprietary, high performance, floating gate CMOS technology. Like all Xicor programmable non-volatile memories the X28HC64 is a 5V only device. The X28HC64 features the JEDEC approved pinout for byte-wide memories, compatible with industry standard RAMs.

The X28HC64 supports a 64-byte page write operation, effectively providing a 32 µs/byte write cycle and enabling the entire memory to be typically written in 0.25 seconds. The X28HC64 also features $\overline{\text{DATA}}$ Polling and Toggle Bit Polling, two methods providing early end of write detection. In addition, the X28HC64 includes a user-optional software data protection mode that further enhances Xicor's hardware write protect capability.

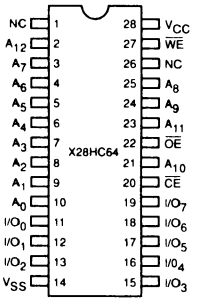
Xicor E²PROMs are designed and tested for applications requiring extended endurance. Inherent data retention is greater than 100 years.

FUNCTIONAL DIAGRAM

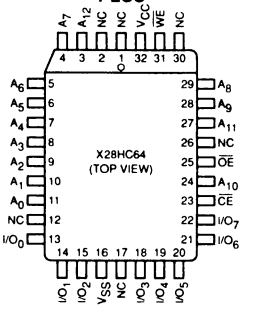


PIN CONFIGURATION

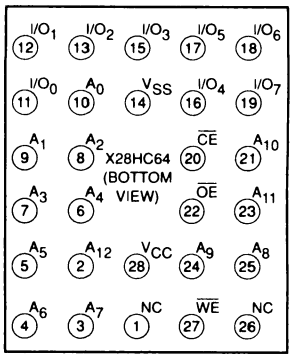
PLASTIC DIP/CERDIP FLAT PACK/SOIC



LCC PLCC



PGA



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Characteristics subject to change without notice

When contacting suppliers, say you saw it in IC MASTER

Xicor

256K X28C256 32K x 8 Bit

Electrically Erasable PROM

FEATURES

- 150 ns Access Time
- Low Power CMOS
  - —60 mA Active Current Max.
  - —200 µA Standby Current Max.
- Fast Write Cycle Times
  - —64-Byte Page Write Operation
  - —Byte or Page Write Cycle: 5 ms Typical
  - —Complete Memory Rewrite: 2.5 Sec. Typical
  - —Effective Byte Write Cycle Time: 78 µs Typical
- Software Data Protection
- End of Write Detection
  - —$\overline{\text{DATA}}$ Polling
  - —Toggle Bit
- Simple Byte and Page Write
  - —Single TTL Compatible $\overline{\text{WE}}$ Signal
  - —Internally Latched Address and Data
  - —Automatic Write Timing
- High Reliability
  - —Endurance: 10,000 Cycles
  - —Data Retention: 100 Years
- Upward Compatible with X2864A
- JEDEC Approved Byte-Wide Pinout

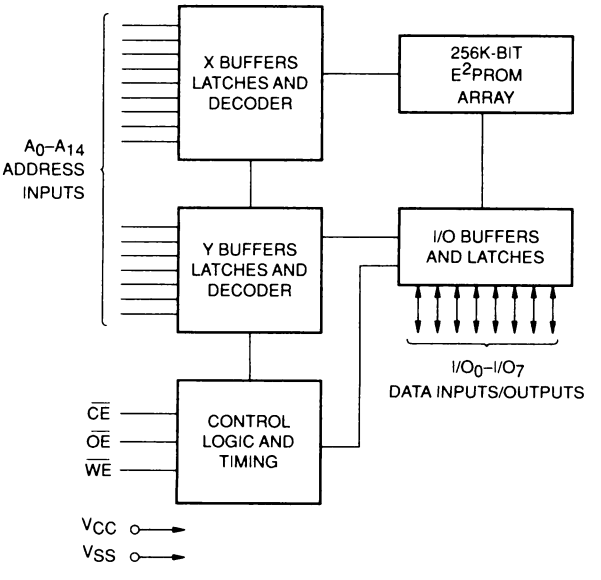
DESCRIPTION

The X28C256 is an 32K x 8 E²PROM, fabricated with Xicor's proprietary, high performance, floating gate CMOS technology. Like all Xicor programmable nonvolatile memories the X28C256 is a 5V only device. The X28C256 features the JEDEC approved pinout for byte-wide memories, compatible with industry standard RAMs.

The X28C256 supports a 64-byte page write operation, effectively providing a 78 µs/byte write cycle and enabling the entire memory to be typically written in less than 2.5 seconds. The X28C256 also features $\overline{\text{DATA}}$ Polling, a system software support scheme used to indicate the early completion of a write cycle. In addition, the X28C256 includes a user-optional software data protection mode that further enhances Xicor's hardware write protect capability.

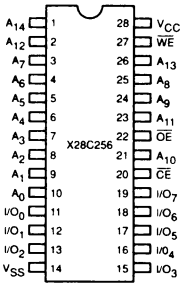
Xicor E²PROMs are designed and tested for applications requiring extended endurance. Inherent data retention is greater than 100 years. Refer to RR-515 for details of data retention characteristics for Xicor nonvolatile memories.

FUNCTIONAL DIAGRAM

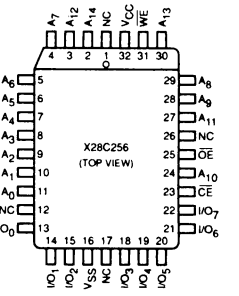


PIN CONFIGURATION

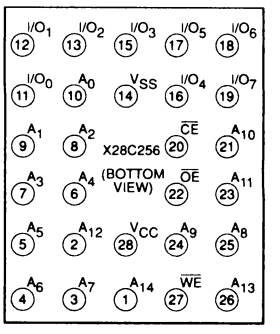
PLASTIC DIP/CERDIP
FLAT PACK/SOIC



LCC
PLCC



PGA



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Characteristics subject to change without notice

Advance Information

256K X28HC256 X28VC256 32K x 8 Bit

High Speed Electrically Erasable PROM

FEATURES

- 5V Only, Byte Alterable
- Fast Access Times
  - —X28VC256: 45, 55, 70 ns
  - —X28HC256: 70, 90, 120 ns
- Low Power CMOS
- High Speed Page Write
  - — Faster Byte Writing: 150ns t_{BLC} Min.
  - — 128-Byte Page Length
  - — Typical 3ms Write Cycle
    - —Complete memory Rewrite: 0.75Sec.
    - —Effective Byte Write Cycle: 24μs
- Software Data Protection
- Early End of Write Detection
  - — $\overline{DATA}$ Polling
  - — Toggle Bit
- High Reliability
  - — Endurance: 10,000 Cycles per Byte
  - — Data Retention: 100 Years
- Compatible With X28C256

DESCRIPTION

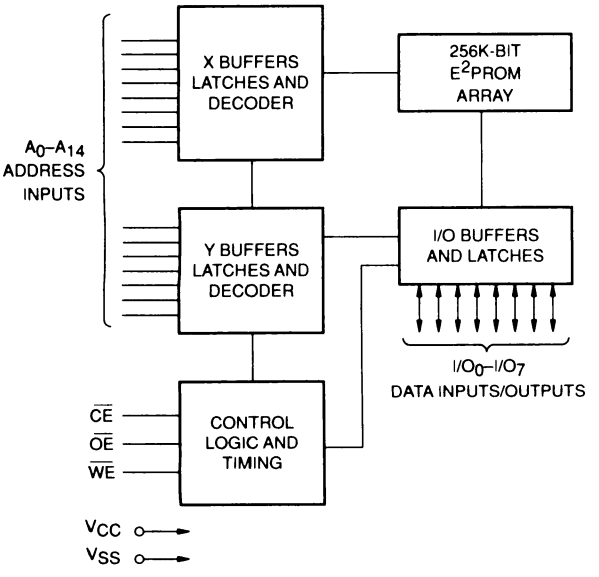
The X28HC256 and X28VC256 are second generation high performance CMOS 32K x 8 E²PROMs. They are fabricated with Xicor's proprietary, textured poly floating gate tech-nology, providing a highly reliable 5 Volt only nonvolatile memory.

Both devices support a 128-byte page write operation, effectively providing a 24μs/byte write cycle and enabling the entire memory to be typically rewritten in less than 0.8 seconds. The devices also feature $\overline{DATA}$ Polling and Toggle Bit polling, two methods of providing early end of write detection. The devices also support the JEDEC standard Software Data Protection feature for protecting against inadvertent writes during power-up and power-down.

Endurance for the devices is specified as a minimum 10,000 write cycles per byte and an inherent data retention of 100 years.

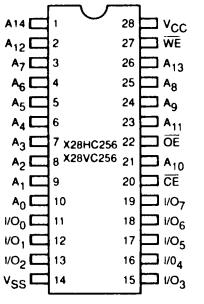
Xicor

FUNCTIONAL DIAGRAM

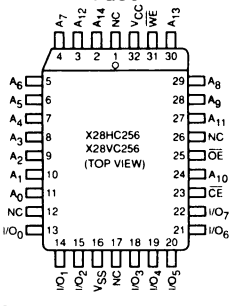


PIN CONFIGURATION

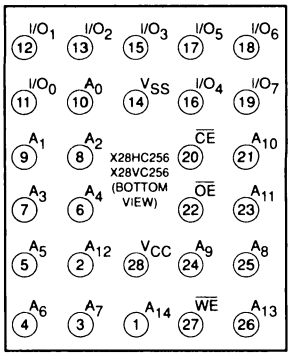
PLASTIC DIP/CERDIP FLAT PACK/SOIC



LCC PLCC



PGA



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Characteristics subject to change without notice

Fact Sheet

256K X28TC256 32K x 8 Bit

Fast Column Access E²PROM

FEATURES

- 35ns Access Time
  - —Within 64-Byte Page Boundaries
  - —Page Crossing Status Output—$\overline{WAIT}$
- 5 Volt Byte and Page Alterable
  - —Write From One to Sixty-Four Bytes
  - —Write Time—5ms Max.
  - —Complete Memory Rewrite: 2.5 Sec. Max.
- Early End of Write Detection
  - —$\overline{DATA}$ Polling
  - —Toggle Bit Polling
  - —Minimize Memory Rewrite: 1.5 Sec. Typical
- Software Data Protection
- Highly Reliable Direct Write™ Cell
  - —Endurance: 10,000 Cycles Per Byte
  - — Data Retention: 100 Years

DESCRIPTION

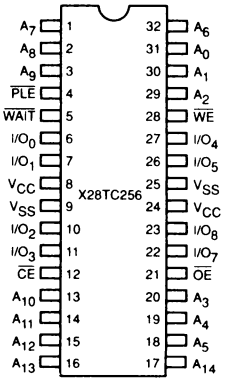
The X28TC256 is a high speed 32K x 8, 5 volt byte alterable nonvolatile memory. It is specially designed to support high speed microprocessors by providing a fast column access time of 35ns for each byte on a 64-byte page. The access time when changing pages will be 150ns maximum. The X28TC256 automatically generates a $\overline{WAIT}$ signal when page boundaries are crossed.

The X28TC256 also features $\overline{DATA}$ Polling and toggle bit polling methods for detecting early end of write. Using either of these polling features, the entire memory can typically be rewritten in 1.5 seconds.

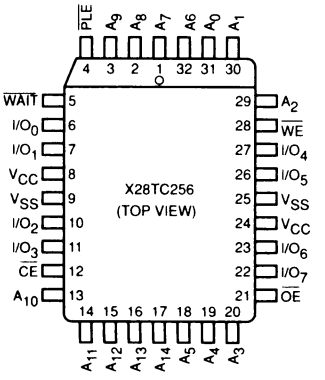
Xicor

PIN CONFIGURATION

PLASTIC DIP
CERDIP



LCC
PLCC



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Characteristics subject to change without notice

512K X28C512 64K x 8 Bit

Electrically Erasable PROM

FEATURES

- 5V only, Byte Alterable
- 120 ns Access Time
- Low Power CMOS
  - —50 mA Active Current Max.
  - —500 µA Standby Current Max.
- Enhanced, High Speed Page Write Operation
- Fast Write Cycle Times
  - —128-Byte Page Size
  - —Byte or Page Write Cycle: 5 ms Typical
  - —Complete Memory Rewrite: 2.5 Sec.
  - —Effective Byte Write Cycle Time: 39 µs
- End of Write Detection
  - —$\overline{\text{DATA}}$ Polling
  - —Toggle Bit Testing Preferred for:
    - —Multiprocessor Applications
    - —Large Memory Arrays
    - —Interrupt Driven Systems
- Software Data Protection
- Two PLCC Pinouts
  - —X28C512–UVEPROM Replacements
  - —X28C513–X28C256 Upgrades
- Inherent 100+ Years Data Retention

DESCRIPTION

The X28C512 is an 64K x 8 E²PROM, fabricated with Xicor's proprietary, high performance, floating gate CMOS technology. Like all Xicor programmable nonvolatile memories the X28C512 is a 5V only device. The X28C512 features the JEDEC approved pinout for bytewide memories, compatible with industry standard EPROMS.

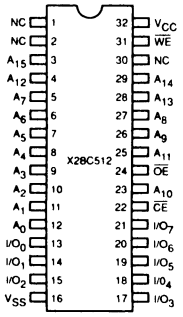
The X28C512 supports a 128-byte page write operation, effectively providing a 39 µs/byte write cycle and enabling the entire memory to be written in less than 2.5 seconds. The X28C512 also features $\overline{\text{DATA}}$ Polling and Toggle Bit testing, system software support schemes used to indicate the early completion of a write cycle. In addition, the X28C512 supports the Software Data Protection option.

Xicor E²PROMs are designed and tested for applications requiring extended endurance.

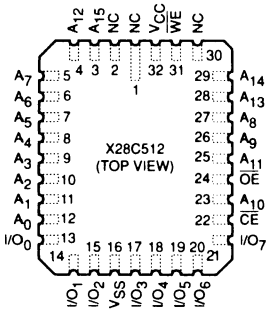
Xicor

PIN CONFIGURATION

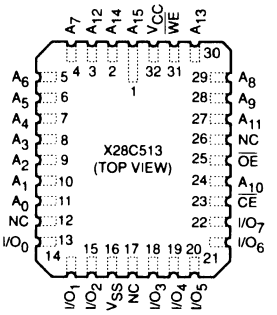
PLASTIC DIP
CERDIP
FLAT PACK



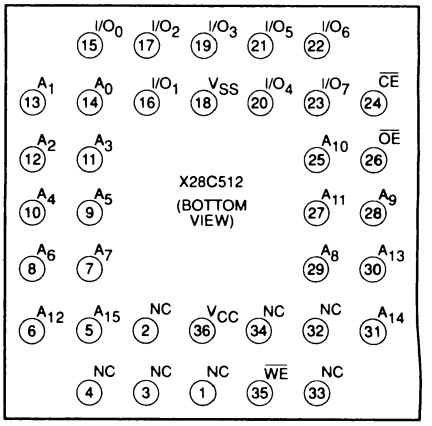
PLCC
LCC



PLCC
LCC



PGA



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Characteristics subject to change without notice

1M X28C010 128K x 8 Bit

Electrically Erasable PROM

FEATURES

- **5V Only—Byte Alterable**
- **120 ns Access Time**
- **Low Power CMOS**
  - **—50 mA Active Current Max.**
  - **—500 μA Standby Current Max.**
- **High Speed Page Write Operation**
- **Fast Write Cycle Times**
  - **—256-Byte Page Write Operation**
  - **—Byte or Page Write Cycle: 5 ms Typical**
  - **—Complete Memory Rewrite: 2.5 Sec.**
  - **—Effective Byte Write Cycle Time: 19 μs**
- **End of Write Detection**
  - **—$\overline{DATA}$ Polling**
  - **—Toggle Bit Testing**
  - **—Accommodates Multiprocessor Applications**
- **Software Data Protection**
- **JEDEC Approved Byte-Wide Pinout for DIPs**

DESCRIPTION

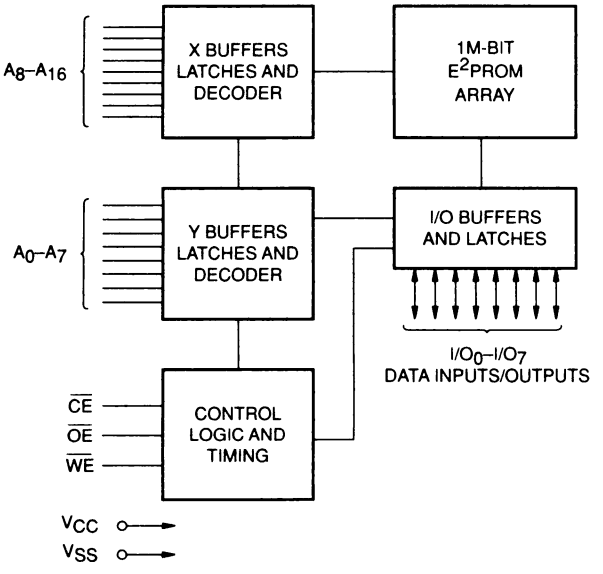
The Xicor X28C010 is a 128K x 8 E²PROM, fabricated with Xicor's proprietary, high performance, floating gate CMOS technology. Like all Xicor programmable nonvolatile memories the X28C010 is a 5V only device. The X28C010 features the JEDEC approved pinout for byte-wide memories, compatible with industry standard EPROMs.

The X28C010 supports a 256-byte page write operation, effectively providing a 19 μs/byte write cycle and enabling the entire memory to be typically written in less than 2.5 seconds. The X28C010 also features $\overline{DATA}$ Polling and Toggle Bit test, system software support schemes used to indicate the early completion of a write cycle. In addition, the X28C010 supports Software Data Protection option.

Xicor E²PROMs are designed and tested for applications requiring extended endurance. Data retention is specified to be greater than 100 years.

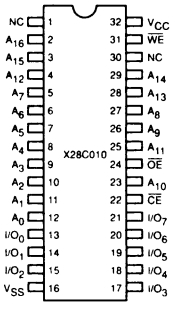
Xicor

FUNCTIONAL DIAGRAM

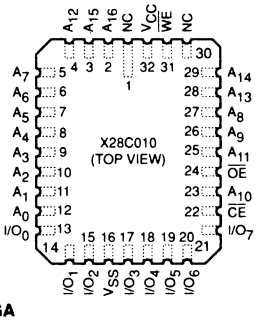


PIN CONFIGURATION

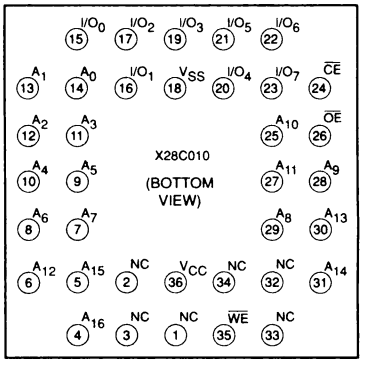
PLASTIC DIP/CERDIP FLAT PACK SOIC



LCC PLCC



PGA



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Characteristics subject to change without notice

Preliminary Information

256 Bit X24C44 16 x 16 Bit

Nonvolatile Static RAM

FEATURES

- **Advanced CMOS Version of Xicor's X2444**
- **16 x 16 Organization**
- **Single 5 Volt Supply**
- **Ideal for use with Single Chip Microcomputers**
  - **—Static Timing**
  - **—Minimum I/O Interface**
  - **—Serial Port Compatible (COPS™, 8051)**
  - **—Easily Interfaced to Microcontroller Ports**
- **Software and Hardware Control of Nonvolatile Functions**
- **Auto Recall on Power-Up**
- **TTL and CMOS Compatible**
- **Low Power Dissipation**
  - **—Active Current: 10 mA Maximum**
  - **—Standby Current: 50 μA Maximum**
- **8 Pin DIP and 8 Lead SOIC Packages**
- **High Reliability**
  - **—Store Cycles: 1,000,000**
  - **—Data Retention: 100 Years**

DESCRIPTION

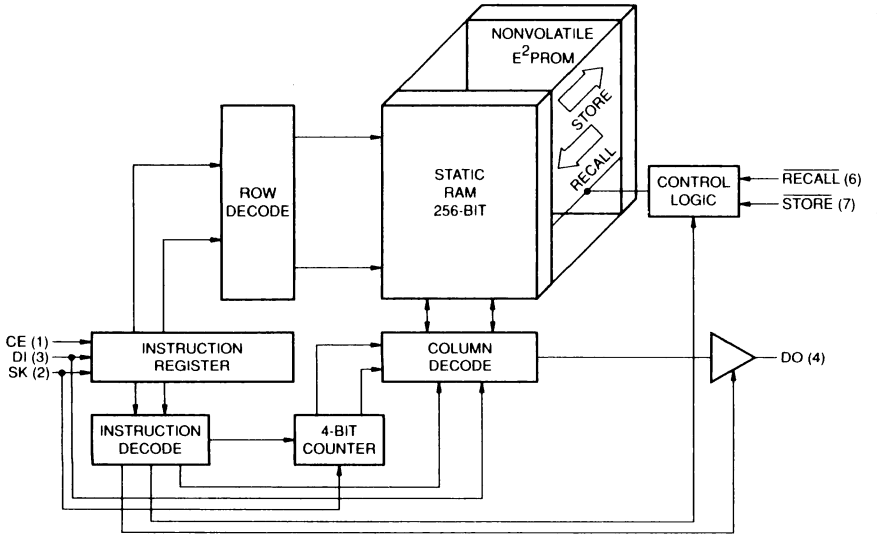
The Xicor X24C44 is a serial 256 bit NOVRAM featuring a static RAM configured 16 x 16, overlaid bit by bit with a nonvolatile E²PROM array. The X24C44 is fabricated with Xicor's Advanced CMOS Floating Gate technology.

The Xicor NOVRAM design allows data to be transferred between the two memory arrays by means of software commands or external hardware inputs. A store operation (RAM data to E²PROM) is completed in 5 ms or less and a recall operation (E²PROM data to RAM) is completed in 2 μs or less.

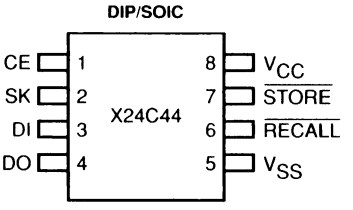
Xicor NOVRAMs are designed for unlimited write operations to RAM, either from the host or recalls from E²PROM and a minimum 1,000,000 store operations. Inherent data retention is specified to be greater than 100 years.

Xicor

FUNCTIONAL DIAGRAM



PIN CONFIGURATION



COPS is a trademark of National Semiconductor Corp.

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Characteristics subject to change without notice

Advanced Information

256 Bit X24C45 16 x 16 Bit

Nonvolatile Static RAM

FEATURES

- **AUTOSTORE™ NOVRAM**
  - **—Automatically Performs a Store Operation Upon Loss of V_{CC}**
- **Single 5 Volt Supply**
- **Ideal for use with Single Chip Microcomputers**
  - **—Minimum I/O Interface**
  - **—Serial Port Compatible (COPS™, 8051)**
  - **—Easily Interfaced to Microcontroller Ports**
- **Software and Hardware Control of Nonvolatile Functions**
- **Auto Recall on Power-Up**
- **TTL and CMOS Compatible**
- **Low Power Dissipation**
  - **—Active Current: 10 mA**
  - **—Standby Current: 50 μA**
- **8 Pin DIP and 8 Lead SOIC Packages**
- **High Reliability**
  - **—Store Cycles: 1,000,000**
  - **—Data Retention: 100 Years**

DESCRIPTION

The Xicor X24C45 is a serial 256 bit NOVRAM featuring a static RAM configured 16 x 16, overlaid bit by bit with a nonvolatile E^2PROM array. The X24C45 is fabricated with Xicor's Advanced CMOS Floating Gate technology.

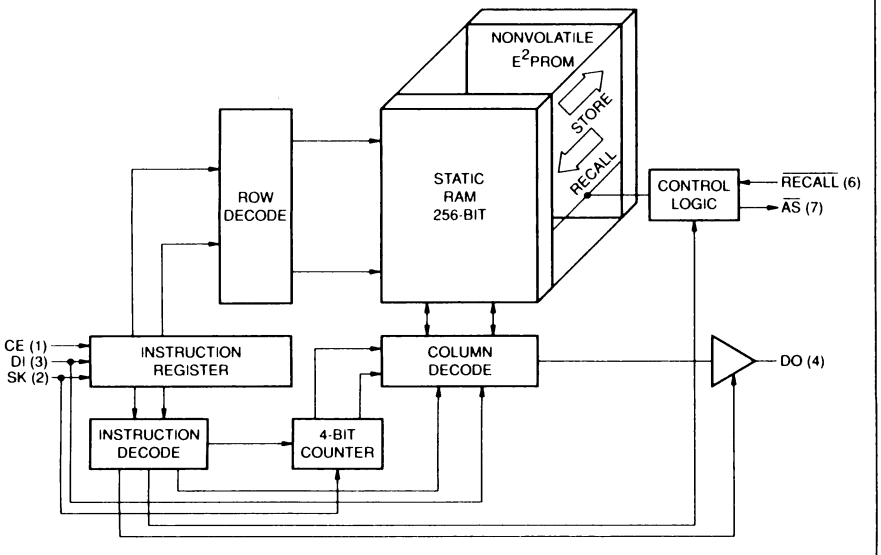
The Xicor NOVRAM design allows data to be transferred between the two memory arrays by means of software commands or external hardware inputs. A store operation (RAM data to E^2PROM) is completed in 5 ms or less and a recall operation (E^2PROM data to RAM) is completed in 2 μs or less.

The X24C45 also features AUTOSTORE, a user selectable feature that will automatically perform a store operation when V_{CC} falls below a preset threshold.

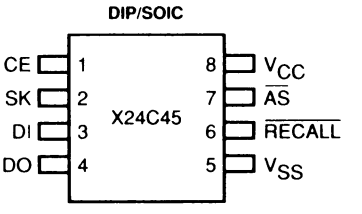
Xicor NOVRAMs are designed for unlimited write operations to RAM, either from the host or recalls from E^2PROM and a minimum 1,000,000 store operations. Inherent data retention is specified to be greater than 100 years.

Xicor

FUNCTIONAL DIAGRAM



PIN CONFIGURATION



AUTOSTORE NOVRAM is a trademark of Xicor, Inc.
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Characteristics subject to change without notice

Preliminary Information

16K X24164 2048 x 8 Bit

Electrically Erasable PROM

FEATURES

- **Low Power CMOS**
  - **—Active Read Current Less Than 1 mA**
  - **—Active Write Current Less Than 3 mA**
  - **—Standby Current Less Than 50 μA**
- **Internally Organized as Eight Banks**
  - **—Each 256 x 8**
- **2 Wire Serial Interface**
  - **—Bidirectional Data Transfer Protocol**
- **Sixteen Byte Page Write Mode**
  - **—Minimizes Total Write Time Per Byte**
- **Self Timed Write Cycle**
  - **—Typical Write Cycle Time of 5 ms**
- **High Reliability**
  - **—Endurance: 100,000 Cycles**
  - **—Data Retention: 100 Years**
- **Pin and Function Compatible with X24C16**
- **8-Pin DIP, 8-Lead SOIC**

DESCRIPTION

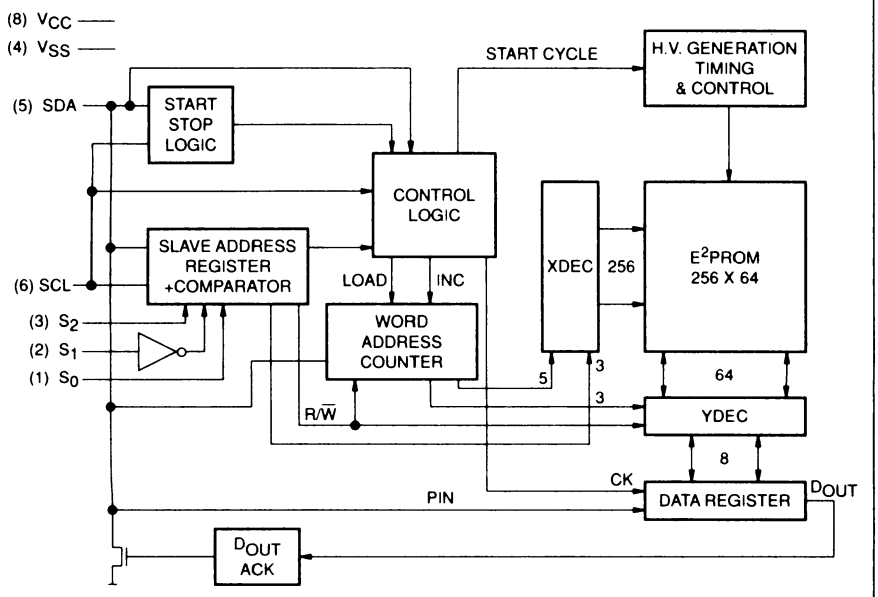
The X24164 is a CMOS 16,384 bit serial E²PROM, internally organized as eight 256 x 8 memory banks. The X24164 features a serial interface and software protocol allowing operation on a simple two wire bus.

Three device select inputs (S_0–S_2) allow up to eight devices to share a common two wire bus.

Xicor E²PROMs are designed and tested for applications requiring extended endurance. Inherent data retention is greater than 100 years.

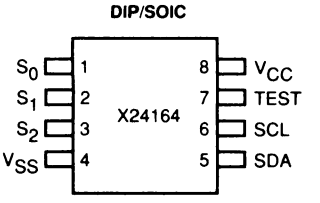
Xicor

FUNCTIONAL DIAGRAM



PIN CONFIGURATION

DIP/SOIC



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Characteristics subject to change without notice

Preliminary Information

128 Bit X24C00 16 x 8 Bit

Electrically Erasable PROM

FEATURES

- 3V to 5.5V Power Supply
- 128 Bit Serial E²PROM
- Low Power CMOS
  - —Active Current Less Than 3 mA
  - —Standby Current Less Than 50 µA
- Internally Organized 16 x 8
- 2 Wire Serial Interface
  - —Bidirectional Data Transfer Protocol
- Byte Mode Write
- Self Timed Write Cycle
  - —Typical Write Cycle Time of 5 ms
- Push/Pull Output
- High Reliability
  - —Endurance: 100,000 Cycles
  - —Data Retention: 100 Years
- 8-Pin Mini-DIP and 8-PIN SOIC Packages

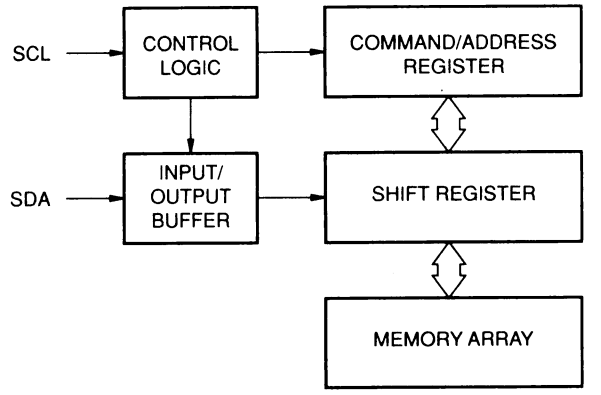
DESCRIPTION

The X24C00 is a CMOS 128 bit serial E²PROM, internally organized as 16 x 8. The X24C00 features a serial interface and software protocol allowing operation on a simple two wire bus.

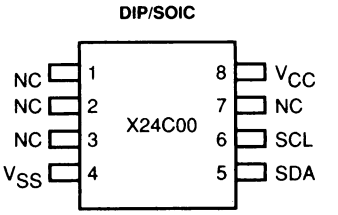
Xicor E²PROMs are designed and tested for applications requiring extended endurance. Inherent data retention is greater than 100 years.

The X24C00 is fabricated with Xicor's Advanced CMOS Floating Gate technology.

FUNCTIONAL DIAGRAM



PIN CONFIGURATION



PIN DESCRIPTIONS

Serial Clock (SCL)

The SCL input is used to clock all data into and out of the device.

Serial Data (SDA)

SDA is a bidirectional pin used to transfer data into and out of the device. It is a push/pull output and does not require the use of a pull-up resistor.

PIN NAMES

Symbol	Description
NC	No Connect
V_{SS}	Ground
V_{CC}	Supply Voltage
SDA	Serial Data
SCL	Serial Clock

3836 PGM T01

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Characteristics subject to change without notice

Full Features

1K/2K/4K/8K/16K 128/256/512/1024/2048 x 8 Bit

Electrically Erasable PROMS

FEATURES

- 2.7V to 5.5V Power Supply
- Low Power CMOS
  - —Active Read Current Less Than 1 mA
  - —Active Write Current Less Than 3 mA
  - —Standby Current Less Than 50 μA
- Byte Organized (8 bits)
- 2 Wire Serial Interface
  - —Bidirectional Data Transfer Protocol
- Page Write Mode
  - —Minimizes Total Write Time Per Byte
- Self Timed Write Cycle
  - —Typical Write Cycle Time of 5 ms
- High Reliability
  - —Endurance: 100,000 Cycles
  - —Data Retention: 100 Years
- 8 Pin DIP and 8 Pin SOIC Packages

DESCRIPTION

Xicor 2-wire, serial E²PROMs, are internally organized in banks of x 8 memory. They all feature a serial interface and software protocol allowing operation on a simple two wire bus.

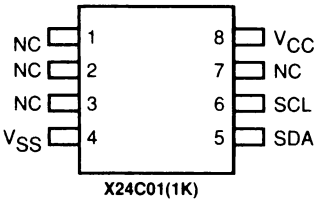
These nonvolatile memory devices are fabricated with Xicor's advanced CMOS Textured Poly Floating Gate Technology.

They utilize Xicor's proprietary Direct Write™ cell providing a minimum endurance of 100,000 cycles and a minimum data retention of 100 years.

Xicor

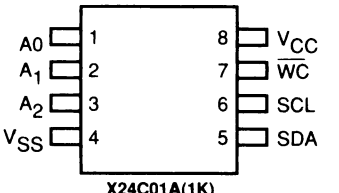
PIN CONFIGURATION

DIP/SOIC



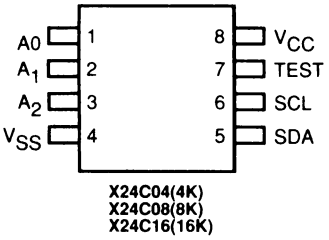
X24C01(1K)

DIP/SOIC



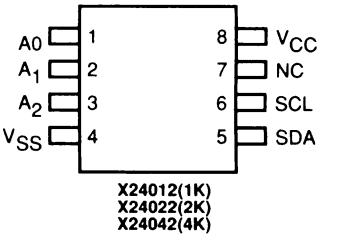
X24C01A(1K)
X24C02(2K)

DIP/SOIC



X24C04(4K)
X24C08(8K)
X24C16(16K)

DIP/SOIC



X24012(1K)
X24022(2K)
X24042(4K)

When contacting suppliers, say you saw it in IC MASTER

Preliminary Information

2K X25C02 256 x 8 Bit

SPI Serial Electrically Erasable PROM

FEATURES

- 1MHz Clock Rate
- 256 X 8 Bits
  - —4 Byte Page Mode
- Low Power CMOS
  - —150μA Standby Current
  - —2mA Active Write Current
- 3V To 5.5V Power Supply
- Built-in Inadvertent Write Protection
  - —Power-Up/Power-Down protection circuitry
  - —Write Latch
  - —Write Protect Pin
- Self-Timed Write Cycle
  - —5mS Write Cycle Time (Typical)
- High Reliability
  - —Endurance: 100,000 cycles per byte
  - —Data Retention: 100 Years
  - —ESD protection: 2000V on all pins
- 8-Pin DIP Package
- 8-Pin SOIC Package

DESCRIPTION

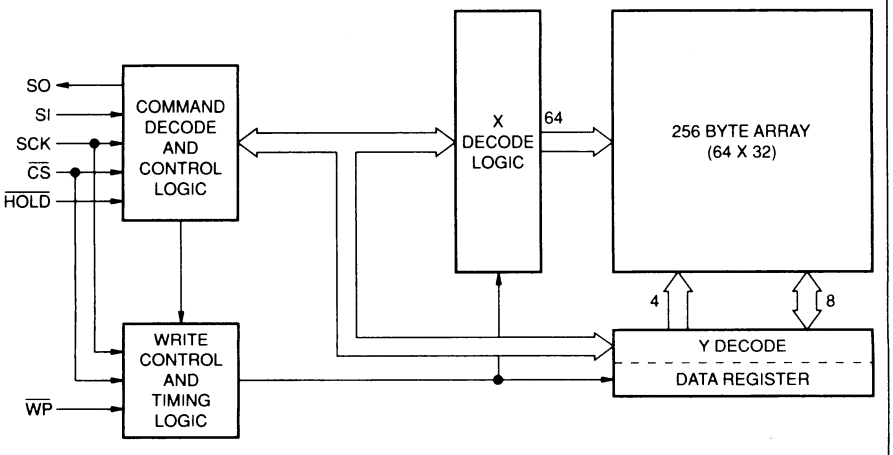
The X25C02 is a CMOS 2048 bit serial E^2PROM, internally organized as 256 x 8. The X25C02 features a serial interface and software protocol allowing operation on a simple three wire bus. The bus signals are a clock input (SCK) plus separate data in (SI) and data out (SO) lines. Access to the device is controlled through a chip select ($\overline{CS}$) input, allowing any number of devices to share the same bus.

The X25C02 also features two additional inputs that provide the end user with added flexibility. By asserting the $\overline{HOLD}$ input, the X25C02 will ignore transitions on its inputs, thus allowing the host to service higher priority interrupts. The $\overline{WP}$ input can be used as a hardwire input to the X25C02 disabling all write attempts; thus providing a mechanism for limiting end user capability of altering the memory.

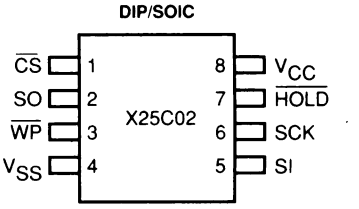
The X25C02 utilizes Xicor's proprietary Direct Write™ cell, providing a minimum endurance of 100,000 cycles per byte and a minimum data retention of 100 years.

Xicor

FUNCTIONAL DIAGRAM



PIN CONFIGURATION



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Characteristics subject to change without notice

Advance Information

4K X25040 512 x 8 Bit

SPI SERIAL E²PROM

FEATURES

- 1MHz Clock Rate
- 512 X 8 Bits
  - —4 Byte Page Mode
- Low Power CMOS
  - —Standby Current Less Than 150 μA
  - —Active Current Less Than 3 mA
- 3V To 5.5V Power Supply
- Block Write Protection
  - —Protect 1/4, 1/2 or all of E²PROM Array
- Built-in Inadvertent Write Protection
  - —Power-Up/Power-Down protection circuitry
  - —Write Latch
  - —Write Protect Pin
- Self-Timed Write Cycle
  - —5mS Write Cycle Time (Typical)
- High Reliability
  - —Endurance: 100,000 cycles per byte
  - —Data Retention: 100 Years
  - —ESD protection: 2000V on all pins
- 8-Pin DIP Package
- 8-Pin SOIC Package

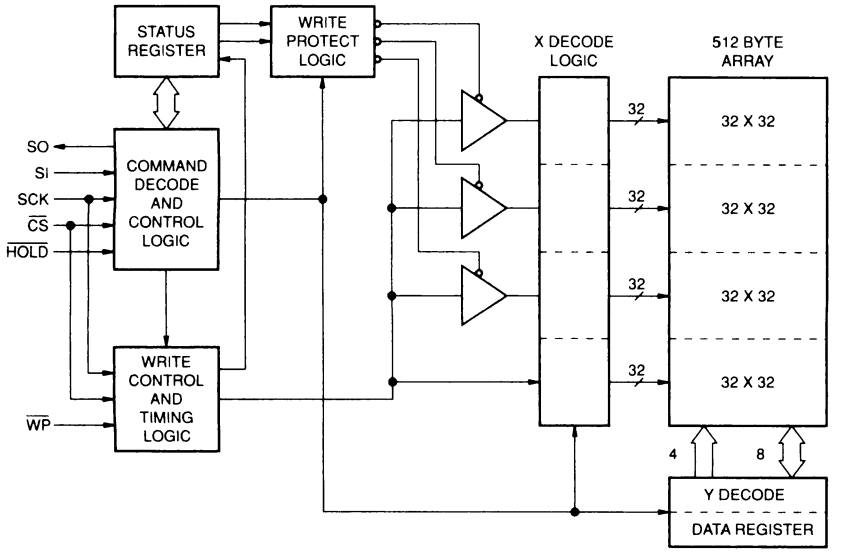
DESCRIPTION

The X25040 is a CMOS 4096 bit serial E²PROM, internally organized as 512 x 8. The X25040 features a serial interface and software protocol allowing operation on a simple three wire bus. The bus signals are a clock input (SCK) plus separate data in (SI) and data out (SO) lines. Access to the device is controlled through a chip select ($\overline{CS}$) input, allowing any number of devices to share the same bus.

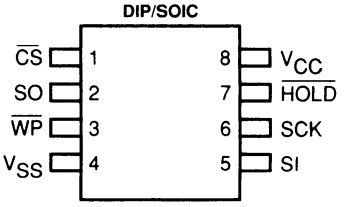
The X25040 also features two additional inputs that provide the end user with added flexibility. By asserting the $\overline{HOLD}$ input, the X25040 will ignore transitions on its inputs, thus allowing the host to service higher priority interrupts. The $\overline{WP}$ input can be used as a hardwire input to the X25040 disabling all write attempts; thus providing a mechanism for limiting end user capability of altering the memory.

The X25040 utilizes Xicor's proprietary Direct Write™ cell, providing a minimum endurance of 100,000 cycles per byte and a minimum data retention of 100 years.

FUNCTIONAL DIAGRAM



PIN CONFIGURATION



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Characteristics subject to change without notice

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Preliminary Information

64K X88C64 8192 x 8 Bit

E^2 Micro-Peripheral

FEATURES

- Concurrent Software Execution While Writing
  - —Dual Plane Architecture
    - —Isolates Read/Write Functions Between Planes
    - —Allows Continuous Execution of Code From One Plane While Writing in the Other Plane
- Multiplexed Address/Data Bus
  - —Direct Interface to Popular 8-Bit Microcontrollers, MCS®-51 Family
- High Performance CMOS
  - —Fast Access Time, 120 ns
  - —Low Power
    - —60 mA Active Maximum
    - —500 µA Standby Maximum
- Software Data Protection
- Block Protect Register
  - —Individually Set Write Lock Out in 1K Blocks
- Toggle Bit
  - —Early End of Write Detection
- Page Mode Write
  - —Allows up to 32 Bytes to be Written in One Write Cycle

DESCRIPTION

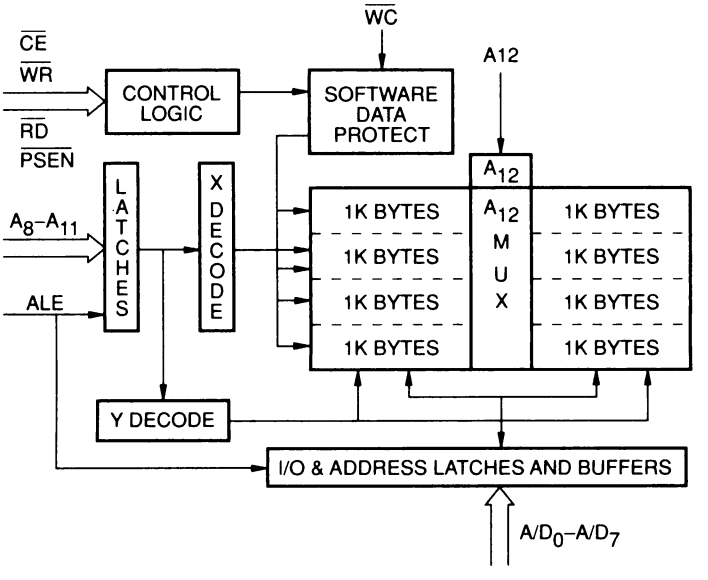
The X88C64 is an 8K x 8 E^2PROM fabricated with advanced CMOS Textured Poly Floating Gate Technology. The X88C64 features a Multiplexed Address and Data bus allowing direct interface to a variety of popular single-chip microcontrollers operating in expanded multiplexed mode without the need for additional interface circuitry.

The X88C64 is internally configured as two independent 4K x 8 memory arrays. This feature provides the ability to perform nonvolatile memory updates in one array and continue operation out of code stored in the other array; effectively eliminating the need for an auxiliary memory device for code storage.

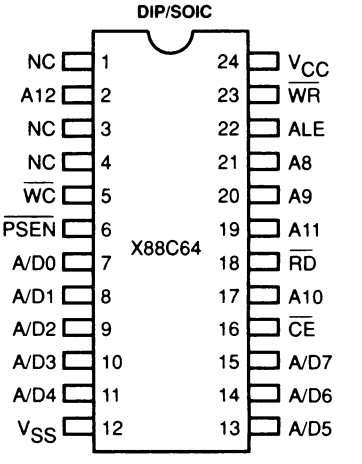
The X88C64 also provides a second generation software data protection scheme called Block Protect. Block Protect can provide write lockout of the entire device or selected 1K blocks. There are 8 1K x 8 blocks that can be write protected individually in any combination required by the user. Block Protect, in addition to Write Control input, allows the different segments of the memory to have varying degrees of alterability in normal system operation.

Xicor

FUNCTIONAL DIAGRAM



PIN CONFIGURATION



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Preliminary Information

64K X68C64 8192 x 8 Bit

E² Micro-Peripheral

FEATURES

- Concurrent Software Execution While Writing
  - —Dual Plane Architecture
    - —Isolates Read/Write Functions Between Planes
    - —Allows Continuous Execution of Code From One Plane While Writing in the Other Plane
- Multiplexed Address/Data Bus
  - —Direct Interface to Popular 8-bit Microcontrollers, e.g. Motorola M6801/03, M68HC11 Family
- High Performance CMOS
  - —Fast Access Time, 120 ns
  - —Low Power
    - —60 mA Maximum Active
    - —500 µA Maximum Standby
- Software Data Protection
- Block Protect Register
  - —Individually Set Write Lock Out in 1K Blocks
- Toggle Bit
  - —Early End of Write Detection
- Page Mode Write
  - —Allows up to 32 Bytes to be Written in One Write Cycle

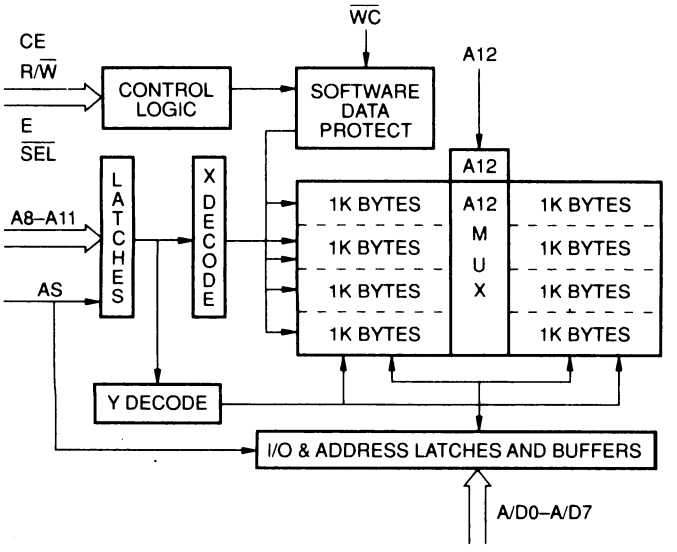
DESCRIPTION

The X68C64 is an 8K x 8 E²PROM fabricated with advanced CMOS Textured Poly Floating Gate Technology. The X68C64 features a Multiplexed Address and Data bus allowing direct interface to a variety of popular single-chip microcontrollers operating in expanded multiplexed mode without the need for additional interface circuitry.

The X68C64 is internally configured as two independent 4K x 8 memory arrays. This feature provides the ability to perform nonvolatile memory updates in one array and continue operation out of code stored in the other array; effectively eliminating the need for an auxiliary memory device for code storage.

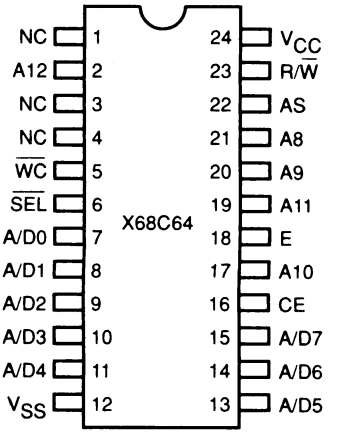
The X68C64 also provides a second generation software data protection scheme called Block Protect. Block Protect can provide write lockout of the entire device or selected 1K blocks. There are 8, 1K x 8 blocks that can be write protected individually in any combination required by the user. Block Protect, in addition to Write Control input, allows the different segments of the memory to have varying degrees of alterability in normal system operation.

FUNCTIONAL DIAGRAM



PIN CONFIGURATION

DIP/SOIC



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Preliminary Information

64K X86C64 8192 x 8 Bit

E² Micro-Peripheral

FEATURES

- Concurrent Software Execution While Writing
  - —Dual Plane Architecture
    - — Isolates Read/Write Functions Between Planes
    - —Allows Continuous Execution of Code From One Plane While Writing in the Other Plane
- Multiplexed Address/Data Bus
  - —Direct Interface to Popular 8-bit Microcontrollers, e.g. Zilog Z8®Family
- High Performance CMOS
  - —Fast Access Time, 120 ns
  - —Low Power
    - — 60 mA Maximum Active
    - — 200 µA Maximum Standby
- Software Data Protection
- Block Protect Register
  - —Individually Set Write Lock Out in 1K Blocks
- Toggle Bit
  - —Early End of Write Detection
- Page Mode Write
  - —Allows up to 32 Bytes to be Written in One Write Cycle

DESCRIPTION

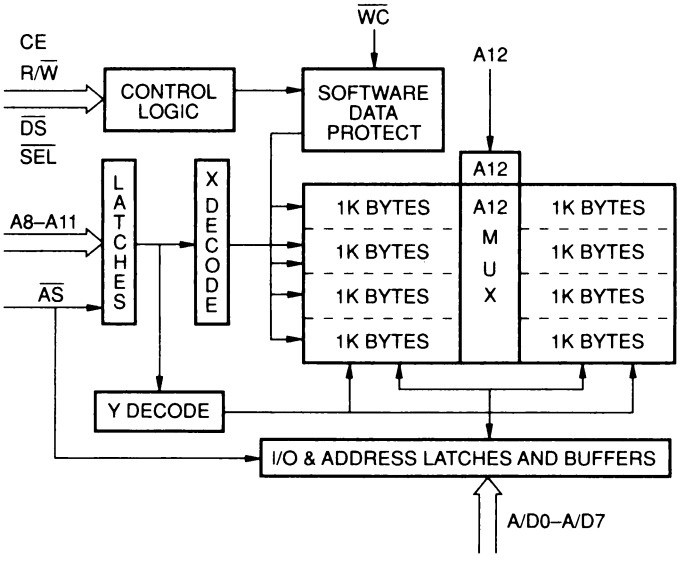
The X86C64 is an 8K x 8 E²PROM fabricated with advanced CMOS Textured Poly Floating Gate Technology. The X86C64 features a Multiplexed Address and Data bus allowing direct interface to a variety of popular single-chip microcontrollers operating in expanded multiplexed mode without the need for additional interface circuitry.

The X86C64 is internally configured as two independent 4K x 8 memory arrays. This feature provides the ability to perform nonvolatile memory updates in one array and continue operation out of code stored in the other array; effectively eliminating the need for an auxiliary memory device for code storage.

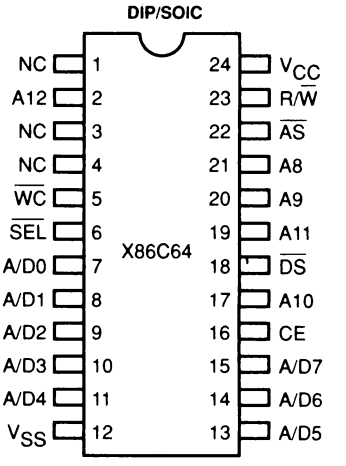
The X86C64 also provides a second generation software data protection scheme called Block Protect. Block Protect can provide write lockout of the entire device or selected 1K blocks. There are 8, 1K x 8 blocks that can be write protected individually in any combination required by the user. Block Protect, in addition to Write Control input, allows the different segments of the memory to have varying degrees of alterability in normal system operation.

Xicor

FUNCTIONAL DIAGRAM



PIN CONFIGURATION



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Characteristics subject to change without notice

Preliminary Information

X9CMME

E²POT™ Digitally Controlled Potentiometer

FEATURES

- **Compatible with X9MME**
- **Low Power CMOS**
  - **—Active Current, 3 mA Max**
  - **—Standby Current, 500 μA Max**
- **99 Resistive Elements**
  - **—Temperature Compensated**
  - **—± 20% End to End Resistance Range**
- **100 Wiper Tap Points**
  - **—Wiper Position via Three Wire Interface**
  - **—Similar to TTL Up/Down Counter**
  - **—Wiper Position Stored in Nonvolatile Memory and Recalled on Power-Up**
- **100 Year Wiper Position Data Retention**
- **X9C102 = 1K Ohms**
- **X9C103 = 10K Ohms**
- **X9C503 = 50K Ohms**
- **X9C104 = 100K Ohms**

DESCRIPTION

The Xicor X9CMME is a solid state nonvolatile potentiometer and is ideal for digitally controlled resistance trimming.

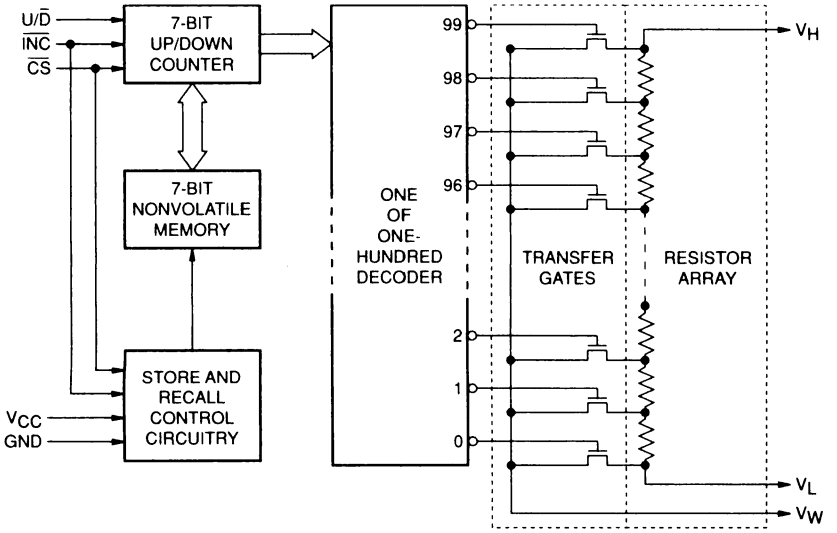
The X9CMME is a resistor array composed of 99 resistive elements. Between each element and at either end are tap points accessible to the wiper element. The position of the wiper element is controlled by the $\overline{CS}$, U/$\overline{D}$, and $\overline{INC}$ inputs. The position of the wiper can be stored in nonvolatile memory and then be recalled upon a subsequent power-on operation.

The resolution of the X9CMME is equal to the maximum resistance value divided by 99. As an example, for the X9C503 (50 KΩ) each tap point represents 505Ω.

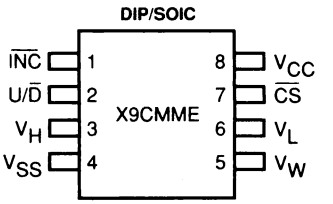
All Xicor nonvolitile memories are designed and tested for applications requiring extended endurance and data retention. Refer to Xicor reliability reports RR-515 and RR-520 for detailed Information.

Xicor

FUNCTIONAL DIAGRAM



PIN CONFIGURATION



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Characteristics subject to change without notice

Advance Information

X9241

Quad E²POT™ Nonvolatile Potentiometer

FEATURES

- Four E²POTs in One Package
- Two Wire Serial Interface
- Register Oriented Format
  - —Directly Write Wiper Position
  - —Read Wiper Position
  - —Store as Many as Four Positions per Pot
- Instruction Format
  - —Quick Transfer of Register Contents to Resistor Array
  - —Cascade Resistor Arrays
- Low Power CMOS
- Direct Write Cell
  - —Endurance - 100,000 Writes per Register
  - —Register Data Retention - 100 years
- 16 Bytes of E²PROM memory
- 3 Resistor Array Values
  - —2K to 50K Ohms Mask Programmable
  - —Cascadable For Values of .5K to 200K Ohms
- Resolution: 64 Taps each pot
- 20-Pin DIP and 20-Lead SOIC Packages

DESCRIPTION

The X9241 integrates four nonvolatile E²POT digitally controlled potentiometers on a monolithic CMOS microcircuit.

The X9241 contains four resistor arrays, each composed of 63 resistive elements. Between each element and at either end are tap points accessible to the wiper elements. The position of the wiper element on the array is controlled by the user through the two wire serial bus interface.

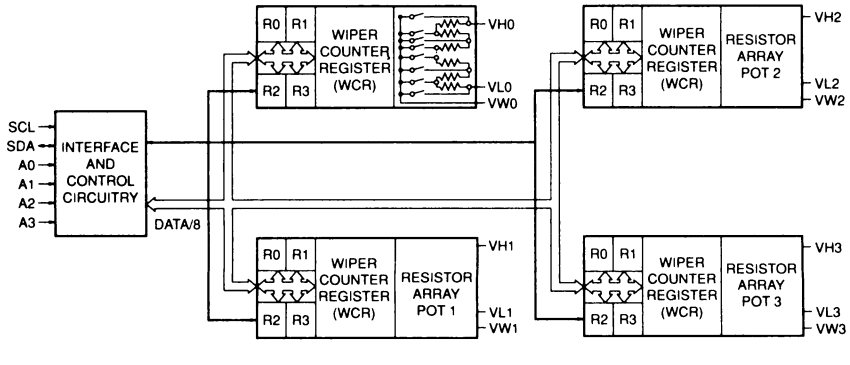
Each resistor array has associated with it a wiper counter register and four 8-bit data registers that can be directly written and read by the user. The contents of the wiper counter register control the position of the wiper on the resistor array.

The data register may be read or written by the user. The contents of the data registers can be transferred to the wiper counter register to position the wiper. The current wiper position can be transferred to any one of its associated data registers.

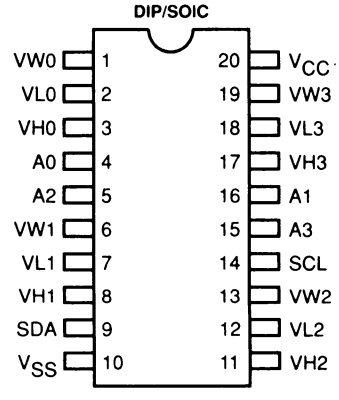
The arrays may be cascaded to form resistive elements with 127, 190 or 253 taps.

Xicor

FUNCTIONAL DIAGRAM



PIN CONFIGURATION



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Characteristics subject to change without notice

Advance Information

X9313

E²POT™ Digitally Controlled Potentiometer

FEATURES

- **Compatible with X9MME and X9CMME**
- **Low Power CMOS**
  - **—Active Current, 3 mA Max**
  - **—Standby Current, 500 μA Max**
- **31 Resistive Elements**
  - **—Temperature Compensated**
  - **—± 20% End to End Resistance Range**
  - **— –5V to +5V Range**
- **32 Wiper Tap Points**
  - **—Wiper Position via Three Wire Interface**
  - **—Similar to TTL Up/Down Counter**
  - **—Wiper Position Stored in Nonvolatile Memory and Recalled on Power-Up**
- **100 Year Wiper Position Data Retention**
- **X9313Z = 1K Ohms**
- **X9313W = 10K Ohms**

DESCRIPTION

The Xicor X9313 is a solid state nonvolatile potentiometer and is ideal for digitally controlled resistance trimming.

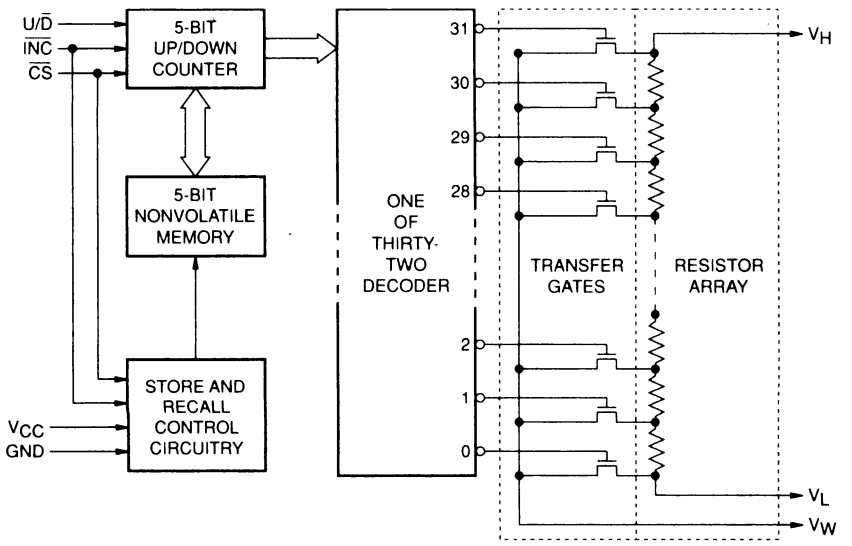
The X9313 is a resistor array composed of 31 resistive elements. Between each element and at either end are tap points accessible to the wiper element. The position of the wiper element is controlled by the $\overline{CS}$, U/$\overline{D}$, and $\overline{INC}$ inputs. The position of the wiper can be stored in nonvolatile memory and then be recalled upon a subsequent power-on operation.

The resolution of the X9313 is equal to the maximum resistance value divided by 31. As an example, for the X9313W (10 KΩ) each tap point represents 323Ω.

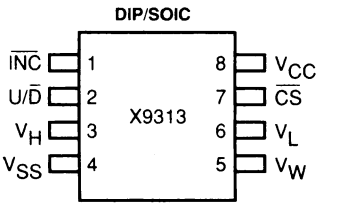
All Xicor nonvolatile memories are designed and tested for applications requiring extended endurance and data retention.

Xicor

FUNCTIONAL DIAGRAM



PIN CONFIGURATION



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Characteristics subject to change without notice

1 Megabit Module — XM28C010 — 128K x 8 Bit

Electrically Erasable PROM

FEATURES

- **High Density 1 Megabit (128K x 8) E^2PROM Module**
- **Access Time of 90 ns at –55°C to +125°C**
- **Base Memory Component: Xicor CMOS X28C256 AND X28VC256**
- **JEDEC Standard 32-Pin 600 Mil Wide Ceramic Side Braze Package**
- **Pin Compatible with the X28C010 1Megabit Monolithic CMOS E^2PROM**
- **Fast Write Cycle Times Supported by:**
  - **—Internal Program Cycle 10 ms Max.**
  - **—64-byte Page**
  - **—$\overline{\text{DATA}}$ Polling**
  - **—Toggle Status Bit**
- **High Rel Module Available with:**
  - **—100% MIL-STD-883 Compliant Components**
- **Software Data Protection**

DESCRIPTION

The XM28C010 is a high density 1 Megabit E^2PROM comprised of four X28C256 32K x 8 LCCs mounted on a co-fired multilayered ceramic substrate. The XM28C010 is configured 128K x 8 bit and features the JEDEC approved pinout for byte-wide memories, compatible with the monolithic X28C010.

The XM28C010 is available in commercial, industrial, and military temperature ranges. The High Rel module is built with MIL-STD-883 Class B microcircuit components. In addition, after being assembled all High Rel modules undergo 100% screening.

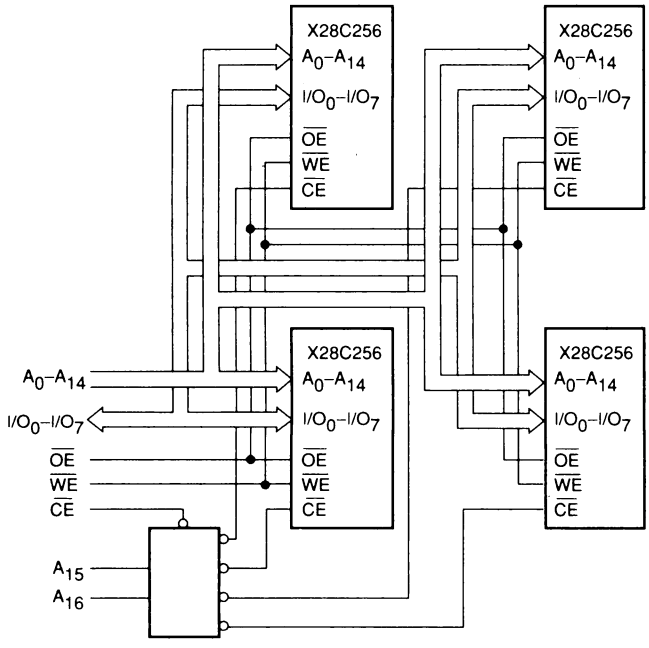
The XM28C010 supports a 64-byte page write operation, this, combined with $\overline{\text{DATA}}$ Polling or Toggle Bit testing, effectively provides a 78µs/byte write cycle, enabling the module memory array to be rewritten in 10 seconds.

The XM28C010 will also support Software Data Protection, a user-optional method of protecting data during power transitions.

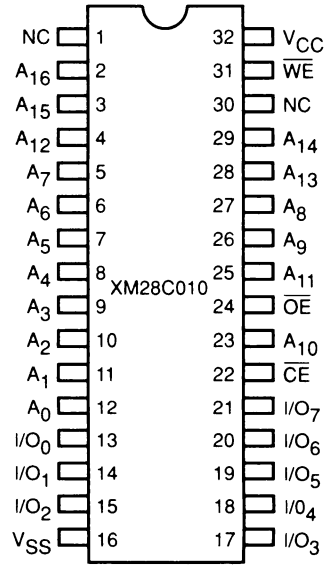
The XM28C010 provides the same high endurance and data retention as the base memory components.

Xicor

FUNCTIONAL DIAGRAM



PIN CONFIGURATION



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Characteristics subject to change without notice

2 Megabit Module — XM28C020 — 256K x 8 Bit

Electrically Erasable PROM

FEATURES

- **High Density 2 Megabit (256K x 8) Module**
- **Access Time of 200ns at –55°C to +125°C**
- **Base Memory Component: Xicor X28C513**
- **Pinout conforms to JEDEC Standard for 2MEG E^2PROM**
- **Fast Write Cycle Times**
  - **—128-byte Page Write**
  - **—Byte or Page Write Cycle: 5ms Typical**
  - **—Complete Memory Rewrite: 10 Seconds**
  - **—Effective Byte Write Cycle: 39 μS**
- **Early End of Write Detection**
  - **—$\overline{\text{DATA}}$ Polling**
  - **—Toggle Bit Polling**
- **Software Data Protection**
- **Three Temperature Ranges**
  - **—Commercial: 0°C to +75°C**
  - **—Industrial: –40° to +85°C**
  - **—Military: –55° to +125°C**
- **High Rel Module Available with**
  - **—100% MIL-STD-883 Compliant Components**

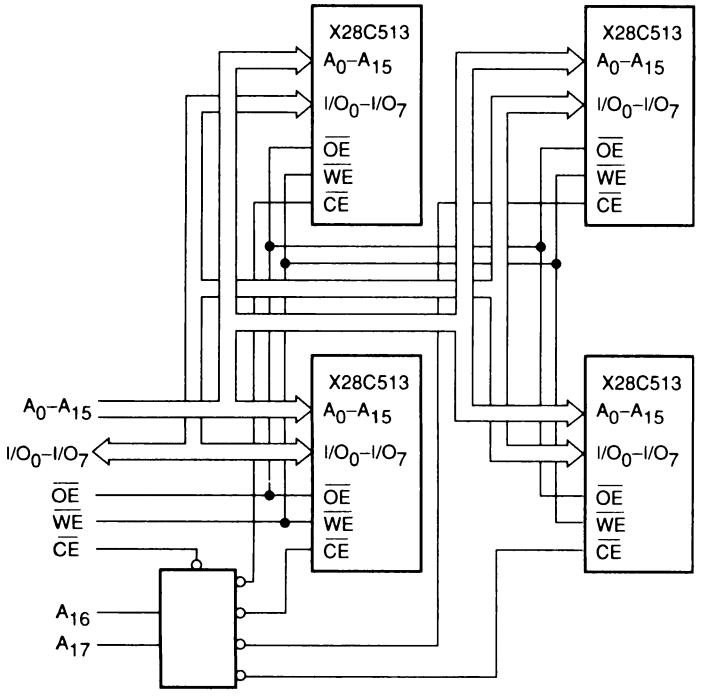
DESCRIPTION

The XM28C020 is a high density 2 Megabit E^2PROM comprised of four X28C513 64K x 8 LCCs mounted on a co-fired multilayered ceramic substrate. Individual components are 100% tested prior to assembly in module form and then 100% tested after assembly.

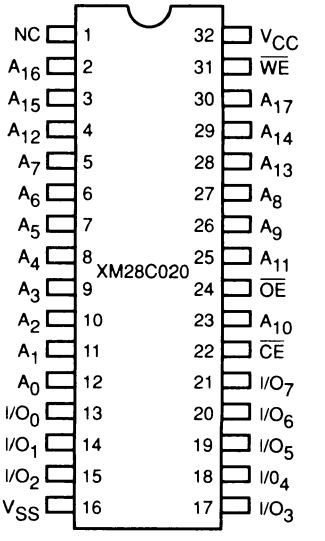
The XM28C020 is configured 256K x 8 bit. The module supports a 128-byte page write operation. This combined with $\overline{\text{DATA}}$ Polling or Toggle Bit Polling, effectively provides a 39μs/byte write cycle, enabling the entire array to be rewritten in 10 seconds.

The XM28C020 provides the same high endurance and data retention as the X28C513.

FUNCTIONAL DIAGRAM



PIN CONFIGURATION



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Characteristics subject to change without notice

Advance Information

4Megabit Module XM28C4096 256K x 16 Bit

High Density E²PROM Module

FEATURES

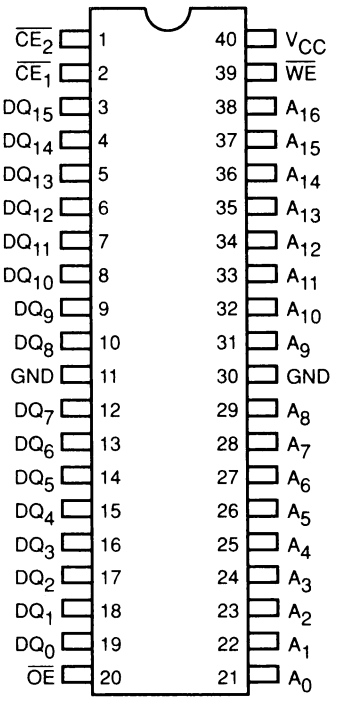
- High Density 4 Megabit (256K x 16) E²PROM Module
- Low Power CMOS technology
  - —Active–Less than 100mA
  - —Standby–Less than 2mA
- Access Time of 150ns
- Base memory Component: Xicor X28C010F
- Fast Write Cycle Times
- 256 Word Page
- Early end of write
  - —$\overline{\text{DATA}}$ Polling
  - —Toggle Bit Polling
- Software Data Protection
- User Accessible Redundant Rows
- Dual Plane Memory Architecture

DESCRIPTION

The XM28C4096 is a high density 4Megabit E²PROM comprised of four X28C010 128K x 8 E²PROMs mounted on a FR-4 substrate. The XM28C4096 is configured 256K x 16 and features two separate Chip Enable inputs to select between two 128K x 16 banks of memory.

The two chip enable inputs provide the interface mechanism for user selection on the implementation of the memory: e.g. Dual plane, concurrent read while write; expanded page, external mapping providing a 512 word page.

PIN CONFIGURATION



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Advance Information

8 Megabit Module — XM28C080S — 1 Meg x 8

High Density E²PROM SIP Module

FEATURES

- High Density 8 Megabit SIP Module
- Industrial Standard 36 PIN SRAM SIP Pinout
- Low Power CMOS Technology
  - —Active – Less Than 60mA
  - —Standby – Less Than 4mA
- Fully Decoded Addresses
- Access Time of 180ns
- Fast Write Cycle Times
- Standard 256 Byte Page
  - —User Configurable to 512, 1024 or 2048 Bytes
- Software Data Protection
- MultiPlane Memory Architecture
  - —Concurrent Read While Write

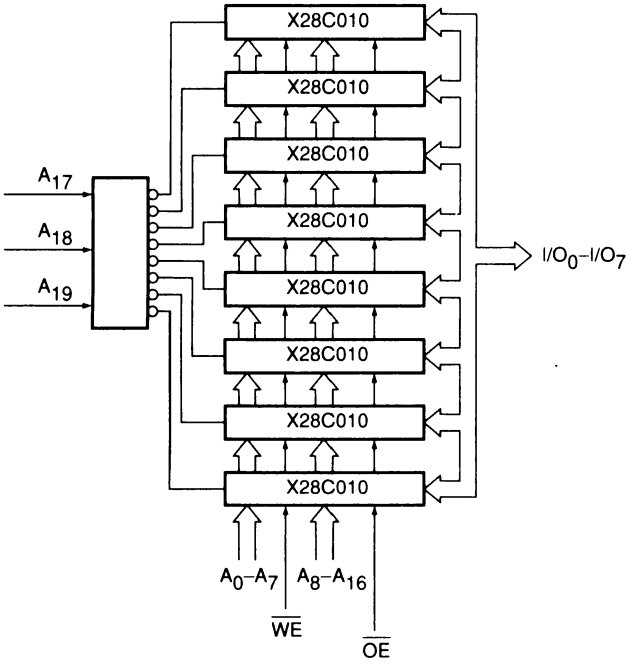
DESCRIPTION

The XM28C080S is a high density 8 Megabit E²PROM module comprised of eight X28C010 128K x 8 E²PROMs mounted on a FR-4 substrate. The XM28C080S is configured 1 Meg x 8 and is fully decoded. The module is a 36 Pin SIP conforming to the industry standard SRAM pinouts.

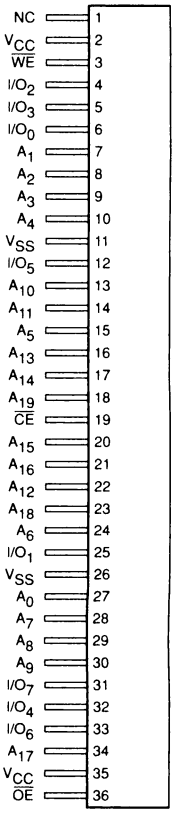
The individual memory components are Xicor's X28C010 1 Megabit E²PROMs, featuring the highly reliable Direct Write™ memory cell. All components are fully tested prior to assembly and then the completed module is 100% electrically tested.

The MultiPlane memory allows concurrent reading of the module while a write operation is currently underway.

FUNCTIONAL DIAGRAM



PIN CONFIGURATION



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Characteristics subject to change without notice

Advance Information

4 Megabit Module — XM28C040 — 512K x 8 Bit

4 MEG E²PROM MODULE

FEATURES

- High Density 4 Megabit (512K x 8) Module
- Access Time of 200ns at –55°C to +125°C
- Base Memory Component: Xicor X28C010
- Pinout conforms to JEDEC Standard for 4MEG E²PROM
- Fast Write Cycle Times
  —256-byte Page Write
- Early End of Write Detection
  —$\overline{DATA}$ Polling
  —Toggle Bit Polling
- Software Data Protection
- Three Temperature Ranges
  —Commercial: 0°C to +75°C
  —Industrial: –40° to +85°C
  —Military: –55° to +125°C
- High Rel Modules all Components are MIL-STD-883 Compliant

DESCRIPTION

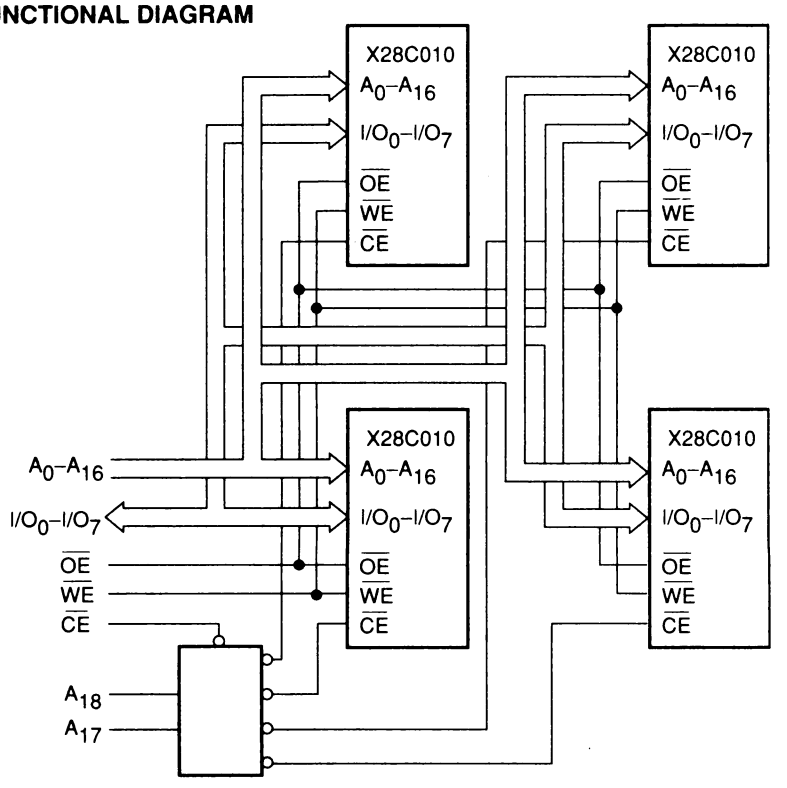
The XM28C040 is a high density 4 Megabit E²PROM comprised of four X28C010's mounted on a co-fired multilayered ceramic substrate. Individual components are 100% tested prior to assembly in module form and then 100% tested after assembly.

The XM28C040 is configured 512K x 8 bit. The module supports a 256-byte page write operation. This combined with $\overline{DATA}$ Polling or Toggle Bit Polling, effectively provides a 39µs/byte write cycle, enabling the entire array to be rewritten in 10 seconds.

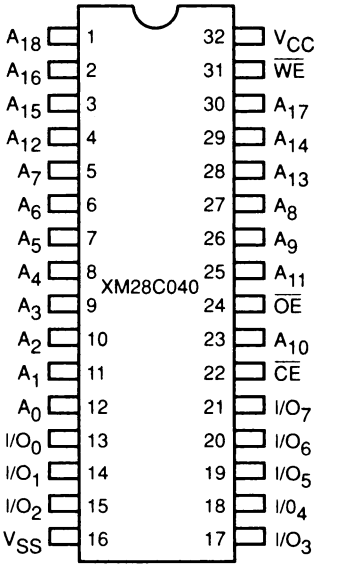
The XM28C040 provides the same high endurance and data retention as the X28C010.

Xicor

FUNCTIONAL DIAGRAM



PIN CONFIGURATION



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Characteristics subject to change without notice

SMD PRODUCT REFERENCE GUIDE

PACKAGING LEGEND—SMD # SUFFIX

M = MIL-STD-883 **UX = PIN GRID ARRAY XX = CERDIP ZX = FLATPACK
PX = CERDIP (8 LEAD) VX = CERDIP (18 LEAD) YX = LCC

SMD #	XICOR P/N	ORGANIZATION	SPEED (NS)	# OF PINS
5962-3826701 MUX	X28C010 EMB-25	128K x 8	250	32
5962-3826701 MXX	X28C010 DMB-25	128K x 8	250	32
5962-3826701 MZX	X28C010 FMB-25	128K x 8	250	32
5962-3826703 MUX	X28C010 EMB-20	128K x 8	200	32
5962-3826703 MXX	X28C010 DMB-20	128K x 8	200	32
5962-3826703 MZX	X28C010 FMB-20	128K x 8	200	32
5962-3826705 MUX	X28C010 EMB-15	128K x 8	150	32
5962-3826705 MXX	X28C010 DMB-15	128K x 8	150	32
5962-3826705 MZX	X28C010 FMB-15	128K x 8	150	32
5962-3826707 MUX	X28C010 EMB-12	128K x 8	120	32
5962-3826707 MXX	X28C010 DMB-12	128K x 8	120	32
5962-3826707 MZX	X28C010 FMB-12	128K x 8	120	32
5962-8683006 XX	X2864B DMB-25	8K x 8	250	28
5962-8683006 YX	X2864B EMB-25	8K x 8	250	32
5962-8683007 XX	X2864B DMB-35	8K x 8	350	28
5962-8683007 YX	X2864B EMB-35	8K x 8	350	32
5962-8751403 XX	X28C64 DMB-25	8K x 8	250	28
5962-8751403 YX	X28C64 EMB-25	8K x 8	250	32
5962-8751403 ZX	X28C64 FMB-25	8K x 8	250	28
5962-8751404 XX	X28C64 DMB-20	8K x 8	200	28
5962-8751404 YX	X28C64 EMB-20	8K x 8	200	32
5962-8751404 ZX	X28C64 FMB-20	8K x 8	200	28
5962-8751405 XX	X28C64 DMB-25 (100K)	8K x 8	250	28
5962-8751405 YX	X28C64 EMB-25 (100K)	8K x 8	250	32
5962-8751405 ZX	X28C64 FMB-25 (100K)	8K x 8	250	28
5962-8764901 XX	X28256 DMB-35	32K x 8	350	28
5962-8764901 YX	X28256 EMB-35	32K x 8	350	32
5962-8764902 XX	X28256 DMB	32K x 8	300	28
5962-8764902 YX	X28256 EMB	32K x 8	300	32
5962-8764903 XX	X28256 DMB-25	32K x 8	250	28
5962-8764903 YX	X28256 EMB-25	32K x 8	250	32
5962-8771201 XX	X2004 DMB-25	512 x 8	250	28
5962-8771201 YX	X2004 EMB-25	512 x 8	250	32
5962-8771202 XX	X2004 DMB	512 x 8	300	28
5962-8771202 YX	X2004 EMB	512 x 8	300	32
5962-8852502 UX	X28C256 KMB	32K x 8	300	28
5962-8852502 XX	X28C256 DMB	32K x 8	300	28
5962-8852502 YX	X28C256 EMB	32K x 8	300	32
5962-8852502 ZX	X28C256 FMB	32K x 8	300	28
5962-8852503 UX	X28C256 KMB-25	32K x 8	250	28
5962-8852503 XX	X28C256 DMB-25	32K x 8	250	28
5962-8852503 YX	X28C256 EMB-25	32K x 8	250	32
5962-8852503 ZX	X28C256 FMB-25	32K x 8	250	28
5962-8852504 UX	X28C256 KMB-20	32K x 8	200	28
5962-8852504 XX	X28C256 DMB-20	32K x 8	200	28
5962-8852504 YX	X28C256 EMB-20	32K x 8	200	32
5962-8852504 ZX	X28C256 FMB-20	32K x 8	200	28
5962-8852505 UX	X28C256 KMB-25 (100K)	32K x 8	250	28
5962-8852505 XX	X28C256 DMB-25 (100K)	32K x 8	250	28
5962-8852505 YX	X28C256 EMB-25 (100K)	32K x 8	250	32
5962-8852505 ZX	X28C256 FMB-25 (100K)	32K x 8	250	28
5962-8852506 UX	X28C256 KMB-15	32K x 8	150	28
5962-8852506 XX	X28C256 DMB-15	32K x 8	150	28
5962-8852506 YX	X28C256 EMB-15	32K x 8	150	32
5962-8852506 ZX	X28C256 FMB-15	32K x 8	150	28
5962-8863401 UX	X28HC256 KMB-12	32K x 8	120	28
5962-8863401 XX	X28HC256 DMB-12	32K x 8	120	28
5962-8863401 YX	X28HC256 EMB-12	32K x 8	120	32
5962-8863401 ZX	X28HC256 FMB-12	32K x 8	120	28
5962-8863403 UX	X28HC256 KMB-90	32K x 8	90	28
5962-8863403 XX	X28HC256 DMB-90	32K x 8	90	28
5962-8863403 YX	X28HC256 EMB-90	32K x 8	90	32
5962-8863403 ZX	X28HC256 FMB-90	32K x 8	90	28
5962-8947401 PX	X2444 DMB	16 x 16	0-1 MHz	8
5962-8959001 PX	X24C04 DMB	512 x 8	0-100 KHz	8
5962-8966701 PX	X24C16 DMB	2K x 8	0-100 KHz	8
5962-8995101 VX	X2212 DMB	256 x 4	300	18
5962-9086901 MUX	X28C512 KMB-25	64K x 8	250	36
5962-9086901 MXX	X28C512 DMB-25	64K x 8	250	32
5962-9086901 MYX	X28C512 EMB-25	64K x 8	250	32
5962-9086901 MZX	X28C512 FMB-25	64K x 8	250	32
5962-9086902 MUX	X28C512 KMB-25	64K x 8	250*	36
5962-9086902 MXX	X28C512 DMB-25	64K x 8	250*	32
5962-9086902 MYX	X28C512 EMB-25	64K x 8	250*	32
5962-9086902 MZX	X28C512 FMB-25	64K x 8	250*	32
5962-9086903 MUX	X28C512 KMB-20	64K x 8	200	36
5962-9086903 MXX	X28C512 DMB-20	64K x 8	200	32
5962-9086903 MYX	X28C512 EMB-20	64K x 8	200	32
5962-9086903 MZX	X28C512 FMB-20	64K x 8	200	32
5962-9086904 MUX	X28C512 KMB-20	64K x 8	200*	36
5962-9086904 MXX	X28C512 DMB-20	64K x 8	200*	32
5962-9086904 MYX	X28C512 EMB-20	64K x 8	200*	32
5962-9086904 MZX	X28C512 FMB-20	64K x 8	200*	32
5962-9086905 MUX	X28C512 KMB-15	64K x 8	150	36
5962-9086905 MXX	X28C512 DMB-15	64K x 8	150	32
5962-9086905 MYX	X28C512 EMB-15	64K x 8	150	32
5962-9086905 MZX	X28C512 FMB-15	64K x 8	150	32
5962-9086906 MUX	X28C512 KMB-15	64K x 8	150*	36
5962-9086906 MXX	X28C512 DMB-15	64K x 8	150*	32
5962-9086906 MYX	X28C512 EMB-15	64K x 8	150*	32
5962-9086906 MZX	X28C512 FMB-15	64K x 8	150*	32
5962-9086907 MUX	X28C512 KMB-12	64K x 8	120	36
5962-9086907 MXX	X28C512 DMB-12	64K x 8	120	32
5962-9086907 MYX	X28C512 EMB-12	64K x 8	120	32
5962-9086907 MZX	X28C512 FMB-12	64K x 8	120	32
5962-9086908 MUX	X28C512 KMB-12	64K x 8	120*	36
5962-9086908 MXX	X28C512 DMB-12	64K x 8	120*	32
5962-9086908 MYX	X28C512 EMB-12	64K x 8	120*	32
5962-9086908 MZX	X28C512 FMB-12	64K x 8	120*	32
5962-9086909 MYX	X28C513 EMB-25	64K x 8	250	32
5962-9086910 MYX	X28C513 EMB-25	64K x 8	250*	32
5962-9086911 MYX	X28C513 EMB-20	64K x 8	200	32
5962-9086912 MYX	X28C513 EMB-20	64K x 8	200*	32
5962-9086913 MYX	X28C513 EMB-15	64K x 8	150	32
5962-9086914 MYX	X28C513 EMB-15	64K x 8	150*	32
5962-9086915 MYX	X28C513 EMB-12	64K x 8	120	32
5962-9086916 MYX	X28C513 EMB-12	64K x 8	120*	32

* Write Cycle Time = 5mS max.
**UX = 32 PAD LCC For 1 Meg SMD

XILINX

XC4000
Logic Cell™ Array Family

Product Description

FEATURES

- Third Generation Field-Programmable Gate Array
  - Abundant flip-flops
  - Flexible function generators
  - On-chip fast RAM
  - Dedicated high-speed carry propagation circuit
  - Fast, wide decoders
  - Efficient implementation of multi-level logic
  - Hierarchy of interconnect lines
  - Internal 3-state bus capability
- Flexible Array Architecture
  - Programmable logic blocks and I/O blocks
  - Programmable interconnects and wide decoders
- Sub-micron CMOS Process
  - High speed (toggle/shift rate >100 MHz)
  - Low power consumption
- Systems-Oriented Features
  - Programmable output slew rate
  - Programmable input pull-up or pull-down resistors
  - 12-mA sink current per output
  - 24-mA sink current per output pair
- Configured by Loading Binary File
  - Unlimited re-programmability
  - Six programming modes
- XACT™ Development system runs on '386/'486-type PCs and on Apollo, Sun-3/4, and DECstation 3100
  - Interfaces to popular design environments like FutureNet, VIEWlogic, Mentor Graphics and OrCAD
  - Fully automatic partitioning, placement and routing
  - Interactive design editor for design optimization
  - 276 macros, 36 hard macros, RAM/ROM compiler

DESCRIPTION

The XC4000 family of Field-Programmable Gate Arrays (FPGAs) provides the benefits of custom CMOS VLSI, while avoiding the initial cost, time delay, and inherent risk of a conventional masked gate array.

The result of experience gained with two successful previous FPGA families (XC2000 and XC3000), the XC4000 family provides a regular, flexible, programmable architecture of Configurable Logic Blocks (CLBs), interconnected by a powerful hierarchy of versatile and abundant routing resources, and surrounded by a perimeter of programmable Input/Output Blocks (IOBs).

The devices are customized by loading configuration data into the internal memory cells. The FPGA can either actively read its configuration data out of external serial or byte-parallel PROM (master modes), or the configuration data can be written into the FPGA (slave and peripheral modes).

The XC4000 family is supported by powerful and sophisticated software, covering every aspect of design: from schematic entry, to simulation, to automatic block placement and routing of interconnects, and finally the creation of the configuration bit stream.

Since Xilinx FPGAs can be re-programmed an unlimited number of times, they can be used in innovative designs where hardware is changed dynamically, or where hardware must be adapted to different user applications.

FPGAs are ideal for shortening the design and development cycle, but they also offer a cost-effective solution for production rates well beyond 1000 systems per month.

Xilinx

Device:	XC4002	4003	4004	4005	4006	4008	4010	4013	4016	4020
Appr. Gate Count:	2,000	3,000	4,000	5,000	6,000	8,000	10,000	13,000	16,000	20,000
CLB Matrix:	8 x 8	10 x 10	12 x 12	14 x 14	16 x 16	18 x 18	20 x 20	24 x 24	26 x 26	30 x 30
Number of CLBs:	64	100	144	196	256	324	400	576	676	900
Number of Flip-Flops:	256	360	480	616	768	936	1120	1536	1768	2280
Max RAM Bits:	2,048	3,200	4,608	6,272	8,192	10,368	12,800	18,432	21,632	28,800
Number of IOBs	64	80	96	112	128	144	160	192	208	240

Table 1. The XC4000 Family of Field-Programmable Gate Arrays

XILINX INC., 2100 LOGIC DRIVE, SAN JOSE, CA 95124 (408) 559-7778

XC4000 Compared to XC3000

For those readers already familiar with the XC3000 family of Xilinx Field Programmable Gate Arrays, here is a concise list of the major new features in the XC4000 family.

CLB has two **independent** 4-input function generators.
A **third** function generator combines the outputs of the two other function generators with a ninth input.
All function inputs are swappable, all have full access; none are mutually exclusive.
CLB has **very fast arithmetic carry** capability.
CLB function generator look-up table can also be used as high-speed **RAM.**
CLB flip-flops have asynchronous set **or** reset.
CLB has **four outputs**, two flip-flops, two combinatorial.
CLB connections symmetrically located on all **four** edges.

IOB has more versatile clocking polarity options.
IOB has programmable input set-up time:
long to avoid potential hold time problems,
short to improve performance.
IOB has Long Line access through its own TBUF.
Outputs are **n-channel only**, lower VOH increases speed, outputs do not clamp to Vcc.
Outputs can be paired to double sink current to **24 mA.**

IEEE 1149.1-type **boundary scan** is supported in the I/O.

Wide decoders on all four edges of the LCA.

Increased **number of interconnect resources.**
All CLB inputs and outputs have **access to most interconnect lines.**
Switch Matrices are simplified to increase speed.
Eight global nets can be used for clocking or distributing logic signals.
TBUF output configuration is more versatile and 3-state control less confined.

Program is single-function input pin, overrides everything.
INIT pin also acts as Configuration Error output.

Synchronous Peripheral Mode (8 bit) has been added.
Asynchronous Peripheral Mode has improved handshake.
Start-up can be **synchronized** to any user clock (this is a configuration option).
No Powerdown, but instead a **Global 3-state input** that does not reset any flip-flops.
No on-chip **crystal oscillator** amplifier.

Configuration Bit Stream includes **CRC error checking.**
Configuration Clock can be increased to **>8 MHz.**
Configuration Clock is **fully static**, no constraint on the maximum Low time.

Readback either ignores flip-flop content (avoids need for masking) or it takes a **snapshot** of all flip-flops at the start of Readback.
Readback has same **polarity** as Configuration and can be **aborted.**

Xilinx

Parameter	XC4000	XC3000	XC2000
Max number of flip-flops	2280	928	174
Max number of user I/O	240	144	74
Max number of RAM bits	28,800	0	0
Function generators per CLB	3	2	2
Number of logic inputs per CLB	9	5	4
Number of logic outputs per CLB	4	2	2
Number of low-skew global nets	8	2	2
Dedicated decoders	yes	no	no
Fast carry logic	yes	no	no
Internal 3-state drivers	yes	yes	no
Output slew-rate control	yes	yes	no
Power-down option	no	yes	yes
Crystal oscillator circuit	no	yes	yes

Table 2. Three Generations of Xilinx Field-Programmable Gate Array Families

DEVELOPMENT SYSTEM

The powerful features of the XC4000 device family require an equally powerful, yet easy-to-use set of development tools. Xilinx provides an enhanced version of the Xilinx Automatic CAE Tools (XACT) optimized for the XC4000 family.

The XACT Design Manager (XDM) simplifies the selection of command-line options with pull-down menus and on-line help text. Application programs ranging from schematic capture to Partitioning, Placement, and Routing (PPR) can be accessed from XDM, while the program-command sequence is generated and stored for documentation prior to execution. The XMAKE command in XDM automates the entire process, from design entry to the generation of configuration and report files.

Similar to that for the XC2000 and XC3000 families, the XC4000 design flow consists of three steps–Design Entry, Design Implementation, and Design Verification.

Design Entry

A design can be entered using schematic-capture software, state-machine description or Boolean-equation entry.

Xilinx and third-party vendors have developed library and interface products compatible with a wide variety of design-entry and simulation environments. A standard interface-file specification, XNF, is provided to simplify file transfers into and out of the XACT development system.

Xilinx offers XACT development-system interfaces to the following design environments.

- FutureNet DASH
- VIEWlogic VIEWdraw and VIEWsim
- Mentor Graphics NETED and QuickSim
- OrCAD SDT and VST
- Cadence Composer Schematic Entry, Verilog Simulator

Several other environments are supported by third-party vendors. Currently, more than 100 packages are supported.

Macro Libraries

Along with the standard library of Soft Macros, like those included with the XC3000 family, the XC4000 family also includes a library of Hard Macros. The Soft Macro library contains detailed descriptions of common logic functions such as counters, adders, etc.; it does not contain any partitioning or routing information. The performance of Soft Macros depends, therefore, on how the PPR software processes the macro.

Hard Macros, on the other hand, do contain complete partitioning, placement, and routing information. These predefined and tested functions permit the user to build timing-critical designs with optimized performance. Designing with Hard Macros is as easy as designing with MSI/LSI.

276 Soft Macros
(Simplify Schematic Entry)

98	Gates
12	Flip-Flops (D, J-K, input mux)
9	Latches (including '259, '373)
15	Decoders (including '42, '48, '138, '139, '154)
19	Multiplexers (including '150...'153, '157, '257, '352)
13	Comparators (2 to 32 bits, identity or magnitude)
12	Adders/Subtactors (2 to 32 bits)
32	Registers (4 to 16 bits)
35	Counters (synchr., 2 to 32 bits, up, dwn, up/dwn, PE)
9	RAMs (16 x 2 to 128 x 8)
18	I/O Circuits
4	Priority Encoders and Parity Checkers

36 Hard Macros
(Pre-Partitioned) Predictable Performance

Adders, Comparators, Multiplexers, Decoders, Encoders, Parity Check
RAMs (4,8,16 wide, 16,32 deep)
FIFOs (4,8,16 wide, 16,32 deep)
LIFOs (4,8,16 wide, 16,32 deep)
Register Files (4,8,16 wide, 16,32 deep)
Counters (synchronous, 8 and 16 bit, up or down, Parallel Enable, utilizing Fast Carry logic)

Design Implementation

The design-implementation tools have been greatly enhanced, to cope with the higher density of the XC4000 devices and to satisfy the requirement for a completely automated design process. Logic partitioning, block placement and signal routing encompass the design implementation process. The partitioner takes the logic from the schematic or other entry method, and divides the logic to fit into the blocks available on the device. The placer then determines the best locations for the blocks, depending on their connectivity and the required performance. The router finally connects the placed blocks together.

The improved PPR algorithms result in fully automatic implementation of most designs. The new algorithms also reduce execution time compared to previous software generations.

The automated implementation tools are complemented by the XACT Design Editor (XDE), an interactive graphics-based editor that displays a model of the actual logic and routing resources of the FPGA. XDE can be used to directly view the results achieved by the automated tools. Modifications can be made using XDE; XDE can also perform checks for logic connectivity and possible design-rule violations.

Interactive point-to-point timing-delay calculations provide timing analysis and help to determine critical paths. The user can, thus, identify and correct timing problems while the design is still in process.

Design Verification

The high development cost associated with common mask-programmed gate arrays necessitates extensive simulation to verify a design. Due to the custom nature of masked gate arrays, mistakes or last-minute design changes cannot be tolerated. A gate-array designer must simulate and test all logic and timing using simulation software. Simulation describes what happens in a system under worst-case situations. However, simulation is tedious and slow; somebody has to write simulation vectors. A few seconds of system time can take weeks to simulate.

Programmable-gate-array users, however, can use in-circuit debugging techniques in addition to simulation. Because Xilinx devices are reprogrammable, designs can be verified in the system in real time without the need for extensive simulation vectors. A design can be verified quickly and easily for basic functionality while in the system.

The XACT development system supports both simulation and in-circuit debugging techniques. For simulation, the system extracts the post-layout timing information from the design database. This data can then be sent to the simulator to verify timing-critical portions of the design.

For in-circuit debugging, XACT has a serial download and readback cable (XChecker) that connects the device in the system to the PC or workstation through an RS232 serial port. The engineer can download a design or a design revision into the system for testing. The designer can also single-step the logic, read the contents of the numerous flip-flops on the device and observe the internal logic levels. Simple modifications can be downloaded into the system in a matter of minutes.

Summary

The result of five years of FPGA design experience and feedback from thousands of customers, the new XC4000 family combines architectural versatility, on-chip RAM, increased speed and gate complexity with abundant routing resources and new, sophisticated software to achieve fully automated implementation of complex, high-performance designs.

CLB Count of Selected XC4000 Soft Macros

7400 Equivalents			
'42	5	CLBs	
'48	8		
'83	4		
'85	4		
'138	4		
'139	2		
'147	4		
'148	6		
'150	5		
'151	2		
'152	2		
'153	2		
'154	9		
'157	2		
'158	2		
'160	5		
'161	6		
'162	5		
'163	7		
'164	4		
'165s	4		
'166	5		
'168	9		
'174	3		
'194	4		
'195	3		
'198	9		
'199	5		
'257	2		
'258	2		
'259	17		
'278	4		
'280	2		
'283	4		
'298	2		
'352	2		
'373	4		
'374	4		
'390	2		
'518	2		
'521	2		
'577	4		
Adders			
add8	8	(5)	CLBs
add16	16	(9)	
add32	32		
Barrel Shifters			
brlshft4	4		
brlshft8	12		
4-Bit Counters			
c10bcrd	2		
c10cprd	4		
c16bcr	2		
c16bcrd	2		
c16cprd	4		
c16budrd	5		

5,6,8-Bit Counters			
c32budrd	6	CLBs	
c64budrd	9		
c256bcr	7		
c256bcrd	5		
c256bcpr	8		
Identity Comparators			
comp4	1		
comp8	2		
comp16	4		
comp32	9		
Magnitude Comparators			
compm4	3		
compm8	8	(5)	
compm16	17	(9)	
compm32	39		
Decoders			
d2-4e	2		
d3-8e	4		
d4-16	8		
d4-16e	16		
FIFOs			
fif16x4	15		
fif16x8	17		
fif16x16	21		
fif32x4	20		
fif32x8	24		
LIFOs (Stacks)			
lif16x4	10		
lif16x8	12		
lif32x4	15		
lif32x8	19		
lif32x16	27		
Multiplexers			
m2-1e	0.5		
m4-1	1		
m4-1e	2		
m8-1e	2		
m16-1e	5		
Registers			
rd4r	2		
rd8r	4		
rd16r	8		
Shift Registers			
rs8p	4		
rsr16	2		
rsr32	16		
Register Files			
rf16x4	2		
rf16x16	8		
rf32x4	4		
rf32x16	16		
RAMs			
ram 16x4	2		
ram 16x8	4		
ram 32x8	8		
ram 64x8	21		

Explanation of counter nomenclature:
b=binary, p=synchronous parallel loadable, ud=up/down, c=count enable, r=synchronous reset, rd=asynchronous reset direct.

Note: When a device is not fully utilized, the automatic partitioner may assign a larger number of CLBs to improve speed and routing. Values in parentheses refer to Hard Macros.

XILINX INC., 2100 LOGIC DRIVE, SAN JOSE, CA 95124 (408) 559-7778

XC3020, XC3030, XC3042 XC3064, XC3090 Logic Cell™ Array

Product Brief

FEATURES

- Fully user-programmable CMOS gate array
  - Flexible internal array architecture
  - 2000–9000 equivalent gates
  - 256–928 flip-flops
  - 64–144 user input/outputs
- Minimum risk
  - Standard product; 100% factory tested
  - No customization
- Second generation architecture
  - 5 input-variable CLBs
  - 2 flip-flops per CLB and IOB
  - Enhanced routing resources
  - 3-state drivers for wide ANDs
- Complete development system support
  - XACT Design Editor
  - Library and User Macros
  - Delay Path Calculator
  - Logic and Timing Simulation
  - Auto Place/Route
  - Schematic Capture for design entry

DESCRIPTION

The XC30XX Logic Cell™ Array (LCA) is a second generation, high performance, static, CMOS integrated circuit. Its extendable, user-programmable array architecture is composed of a configuration program store plus three types of configurable elements: a perimeter of I/O blocks, a core array of logic blocks and an interleaved interconnect. The XACT Development System allows the user to define the logic functions of the device. Schematic capture and auto place-and-route are available for design entry, while logic and timing simulation, and in-circuit debugging are available for design verification. XACT is used to compile the data pattern which represents the configuration program. This data can be converted to a PROM programmer format file to create the configuration program storage.

The LCA's user logic functions and interconnections are determined by the configuration program data stored in internal static memory cells. The program can be loaded in any of several modes to accommodate various system requirements. The XC30XX's resources are programmed to form networks carrying logic signals among blocks, analogous to traces on a printed circuit board connecting MSI/SSI packages.

CONFIGURATION MEMORY

Compared with other programming alternatives, static memory provides the best combination of high density, high performance, high reliability and comprehensive testability. The static memory cell used for the configuration memory in the LCA has been designed specifically for high reliability and noise immunity. The basic memory cell consists of two CMOS inverters plus a pass transistor used for writing and reading cell data. The cell is only written during configuration and only read during readback. The memory-cell outputs have a low impedance to either ground or V_{CC}.

I/O BLOCK

Each of the user configurable I/O Blocks (IOBs) provides an interface between the external package pin of the device and the internal user logic. The IOB includes both registered and direct input paths. Each package pin provides a progammable 3-state output buffer which may be driven by a registered or direct output signal. Configuration options allow inversion, slew rate selection and a high impedance pull-up. See Figure 1.

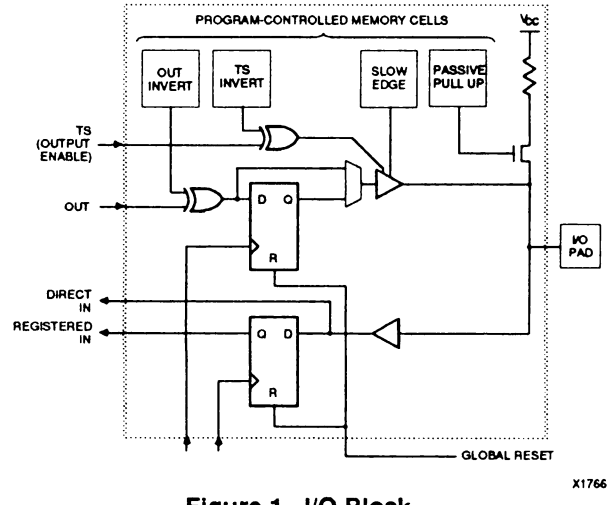

Figure 1. I/O Block

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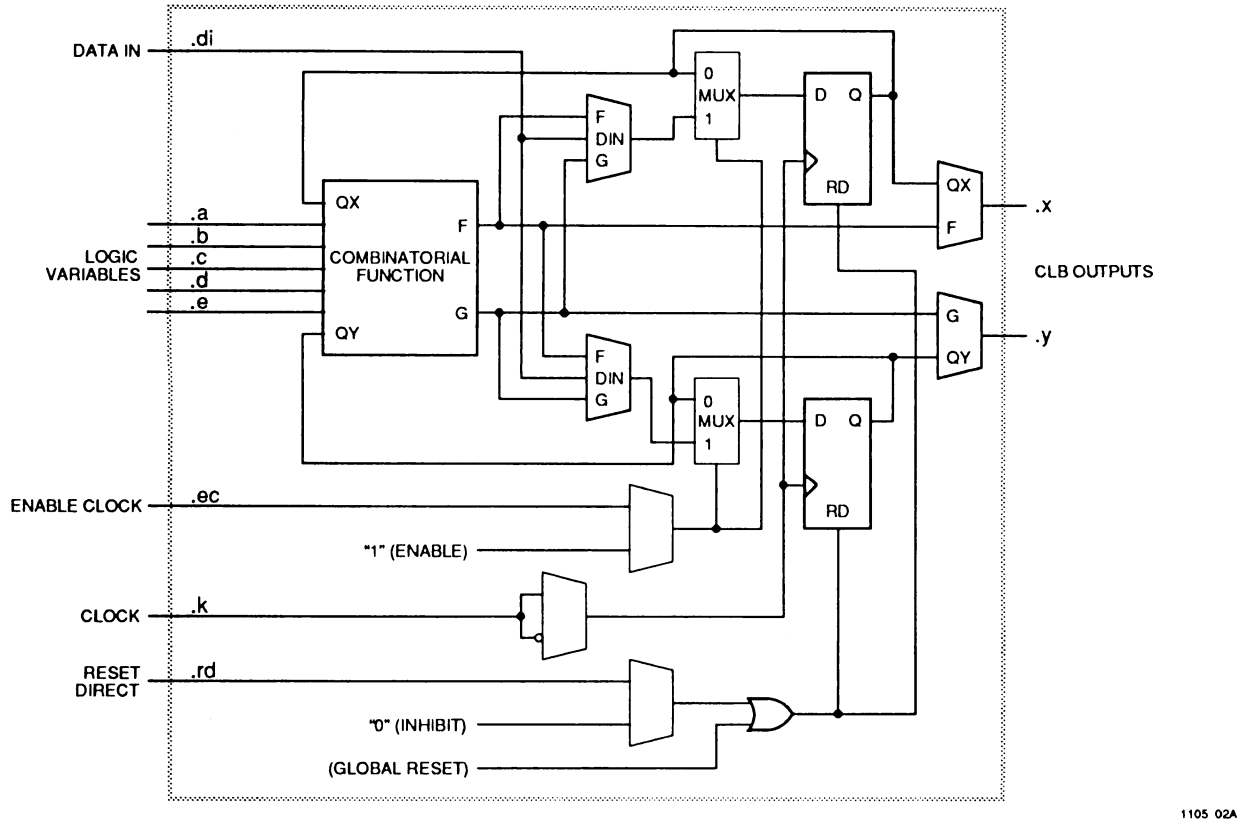

Figure 2. Configurable Logic Block

Xilinx

CONFIGURABLE LOGIC BLOCK

The array of Configurable Logic Blocks (CLBs) provides the functional elements from which the user's logic is constructed. Each configurable logic block has a combinatorial logic section, two flip-flops, and an internal control section. See Figure 2. There are: five logic inputs (.a–.e); a common clock; an asynchronous direct reset; an enable clock; and a direct flip-flop input, all of which may be driven from the interconnect resources. Each CLB also has two outputs which drive interconnect networks. Data input for either flip-flop within a CLB is supplied form the function F or G outputs of the combinatorial logic, or the block input data-in.

The combinatorial logic portion of the CLB uses a program memory 32 x 1 table look-up to implement Boolean functions. Variables selected from the five logic inputs and two internal block flip-flops are used as table address inputs. The combinatorial propagation delay through the network is independent of the logic function generated and is spike free for single input variable changes. This technique can generate two independent logic functions of up to four variables each, or a single function of five variables, or some functions of seven variables.

PROGRAMMABLE INTERCONNECT

Programmable interconnection resources in the LCA provide routing paths to connect inputs and outputs of the I/O and logic blocks into logical networks. All interconnections between blocks are composed from a grid of metal segments. Specially designed pass transistors, each controlled by a configuration bit, allow the configuration program to determine the networks.

Device	XC3020	XC3030	XC3042	XC3064	XC3090
Gates	2000	3000	4200	6400	9000
CLBs Row x Col	64 (8 x 8)	100 (10 x 10)	144 (12 x 12)	224 (16 x 14)	320 (20 x 16)
IOBs	64	80	96	120	144
Flip-flops	256	360	480	688	928
Horizontal Long Lines	16	20	24	32	40
TUBFs per Horizontal LL	9	11	13	15	17

XILINX

Component Availability

		44 PIN	48 PIN		68 PIN		84 PIN		100 PIN		132 PIN		160 PIN	164 PIN	175 PIN	
		PLASTIC PLCC	PLASTIC DIP	CERAMIC DIP	PLASTIC PLCC	CERAMIC PGA	PLASTIC PCC	CERAMIC PGA	PLASTIC PQFP	CERAMIC CQFP	PLASTIC PGA	CERAMIC PGA	PLASTIC PQFP	CERAMIC CQFP	PLASTIC PGA	CERAMIC PGA
		PC44	PD48	CD48	PC68	PG68	PC84	PG84	PQ100	CQ100	PP132	PG132	PQ160	CQ164	PP175	PG175
XC2064	-50		C	I	CI	CIM										
	-70				CI	CIM										
	-100				C	C										
XC2018	-33							MB								
	-50				CI		CI	CIMB								
	-70				CI		CI	CIMB								
	-100				C		C	C								
XC3020	-50				CI		CI	CIMB	CI	CIMB						
	-70				CI		CI	CIMB	CI	CIMB						
	-100				CI		CI	CI	C	C						
	-125				C		C	C	C							
XC3030	-50	CI			CI		CI	CIM	C							
	-70	CI			CI		CI	CIM	CI							
	-100	C			CI		CI	CI	C							
	-125	C			C		C	C	C							
XC3042	-50						CI	CIMB	C	CMB	CI	CIMB				
	-70						CI	CIMB	CI	CMB	CI	CI				
	-100						CI	CI	CI	C	CI	CI				
	-125						C	C	C		C	C				
XC3064	-50						C				CI	CIM	C			
	-70						C				CI	CIM	C			
	-100						CI				CI	CI	C			
	-125						C				C	C	C			
XC3090	-50						CI						CI	CMB	CI	CIMB
	-70						CI						CI	CMB	CI	CIMB
	-100						CI						CI	C	CI	CI
	-125						C						C		C	C

X1104A

		84 PIN	100 PIN	120 PIN	156 PIN	160 PIN	191 PIN	208 PIN
		PLASTIC PLCC	PLASTIC PQFP	CERAMIC PGA	CERAMIC PGA	PLASTIC PQFP	CERAMIC PGA	PLASTIC PQFP
		PC84	PQ100	PG120	PG156	PQ160	PG191	PQ208
XC4003	-6	NOW		NOW				
	-5	NOW		NOW				
XC4005	-6	NOW			NOW	NOW		
	-5	NOW			NOW	NOW		
XC4006	-6							
	-5							
XC4008	-6							
	-5							
XC4010	-6							
	-5							

X1104C

	8 PIN	8 PIN	20 PIN
	PLASTIC MINIDIP	CERDIP	PLASTIC PLCC
	PD8	DD8	PC20
XC1736A	NOW	NOW	NOW
XC1765	NOW	NOW	NOW
XC17128			

X1104D

Speed designation differs between families:

XC2000 and XC3000 families are labeled with their max flip-flop toggle rate in MHz. Typical synchronous system clock rates should not exceed 30 to 40% of this frequency, but counters can be built up to the designated flip-flop toggle rate.

XC4000 devices are labeled with their intrinsic block propagation delay in nanoseconds, which makes it easier to estimate performance.

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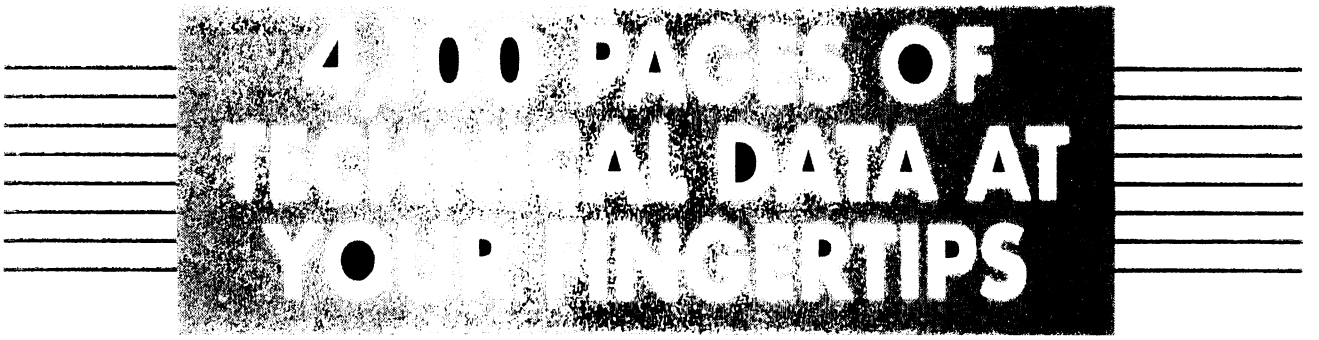

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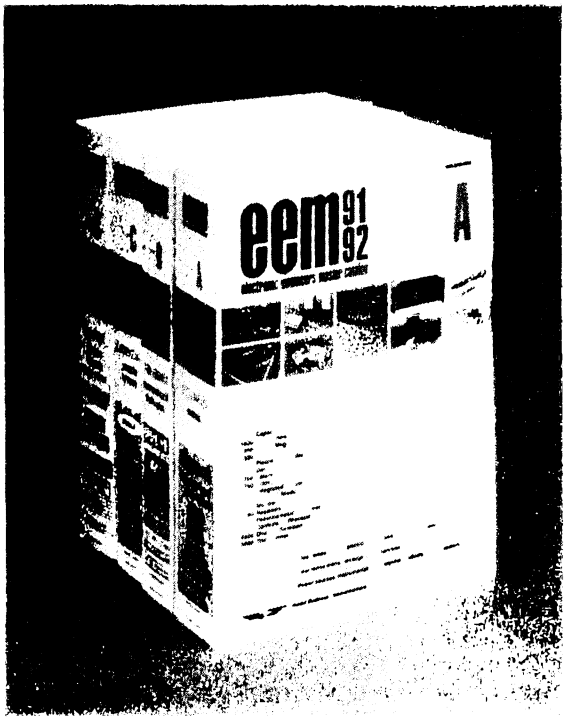

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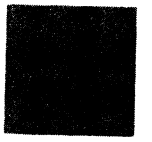

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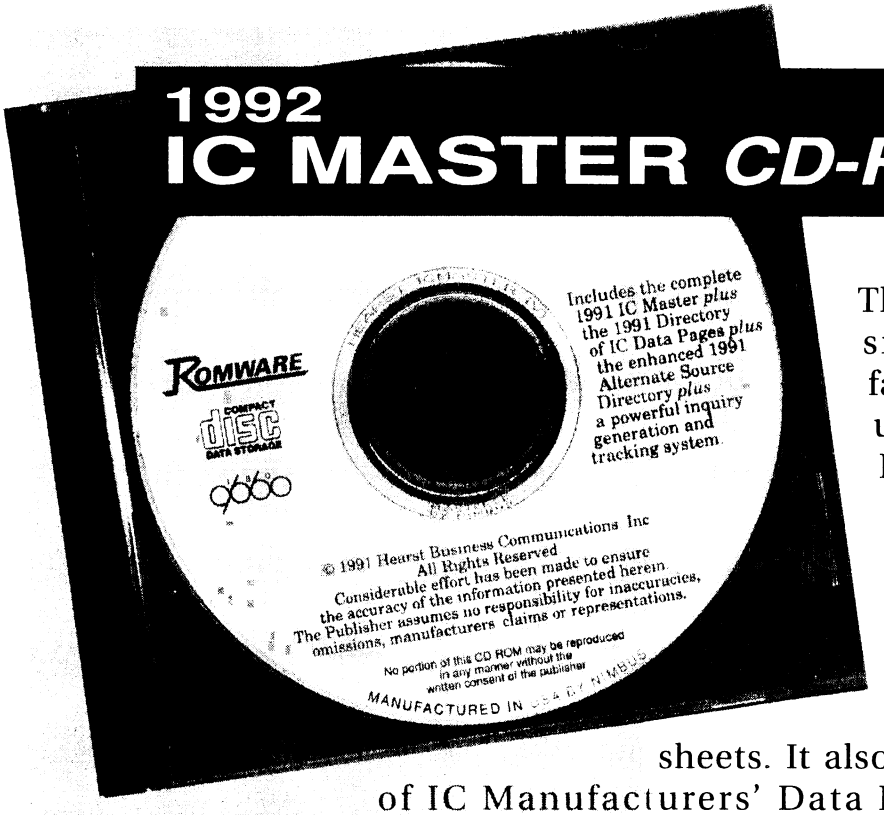
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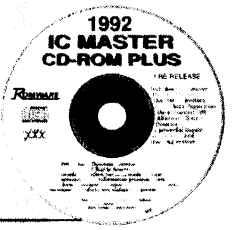

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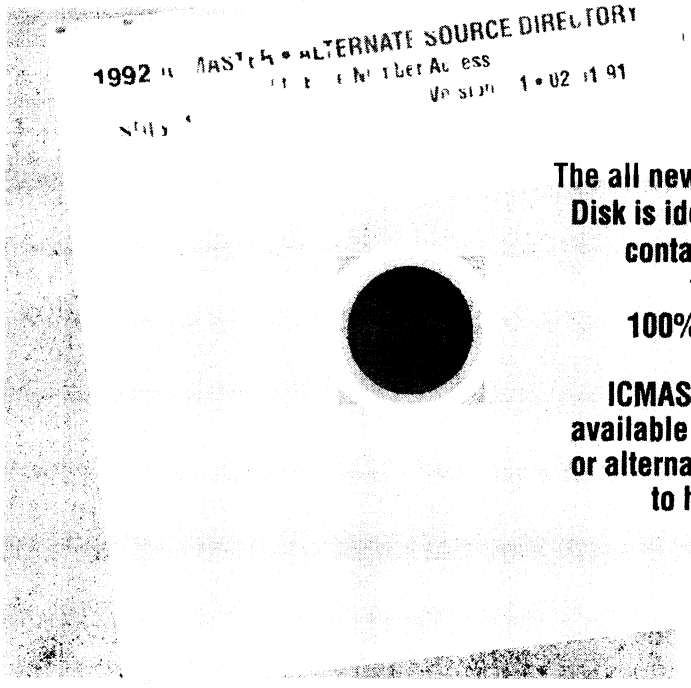

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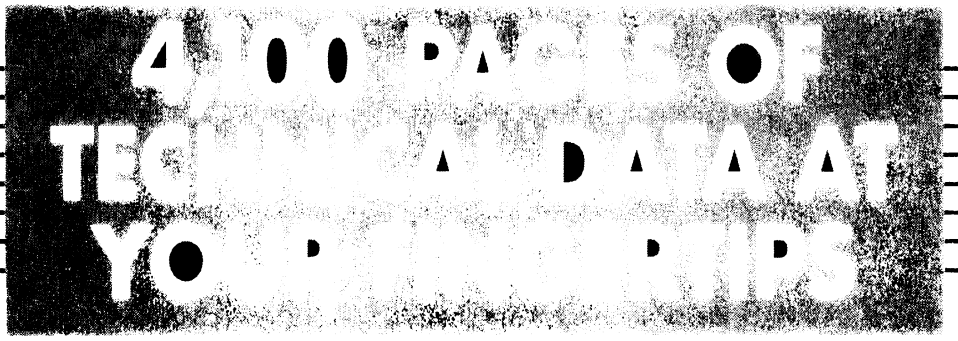

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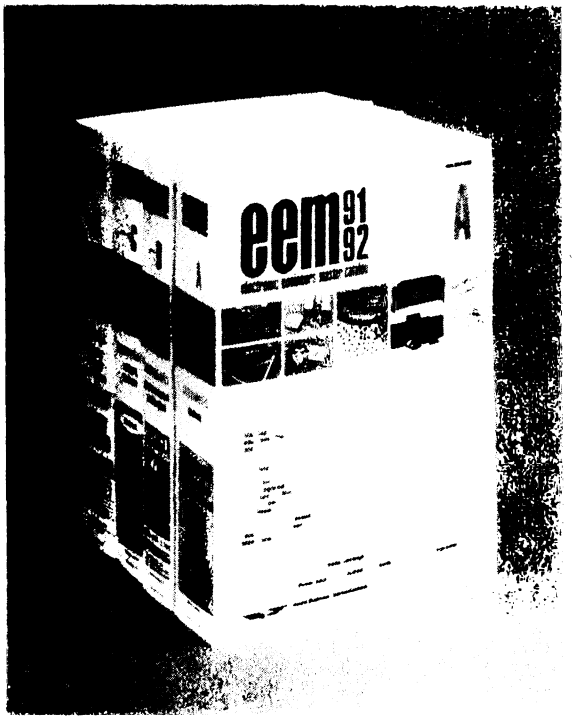

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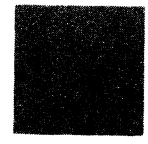

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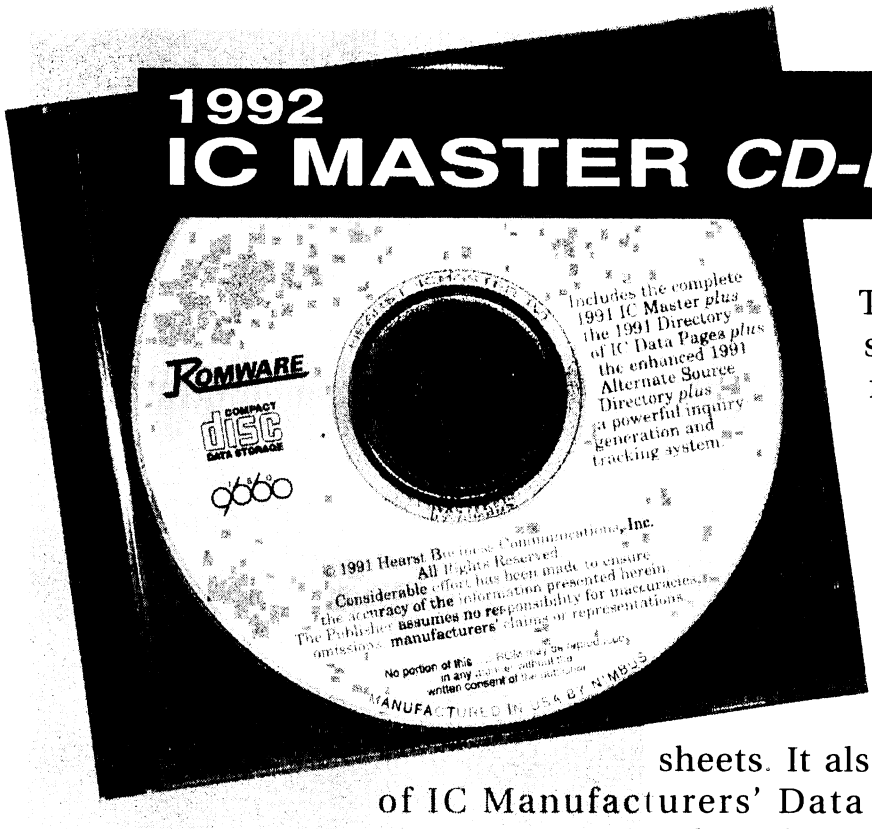
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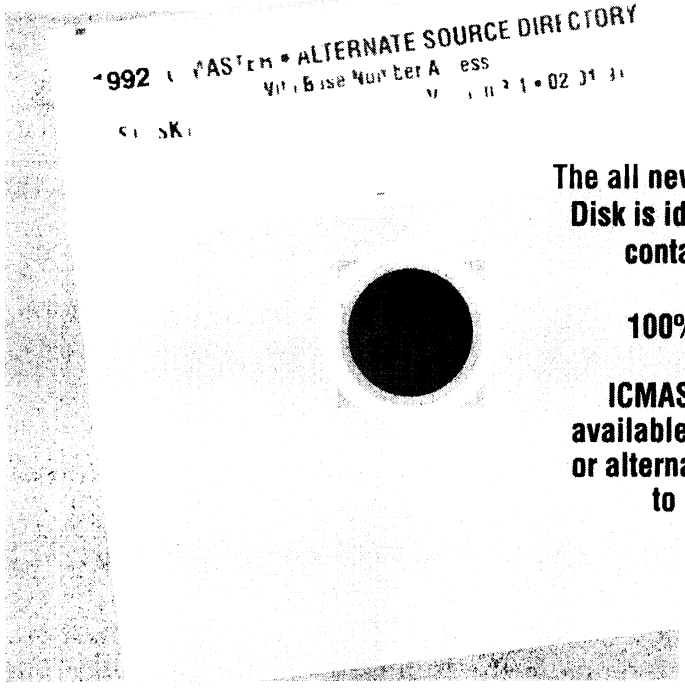

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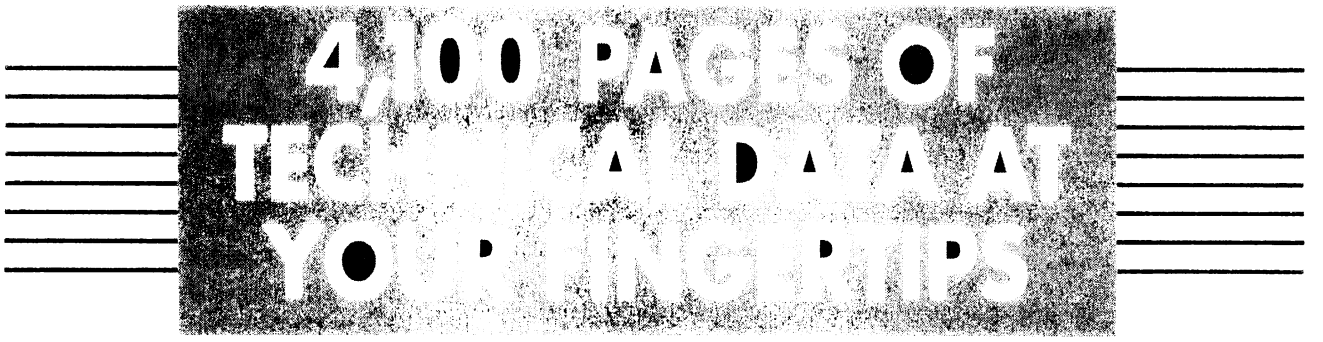

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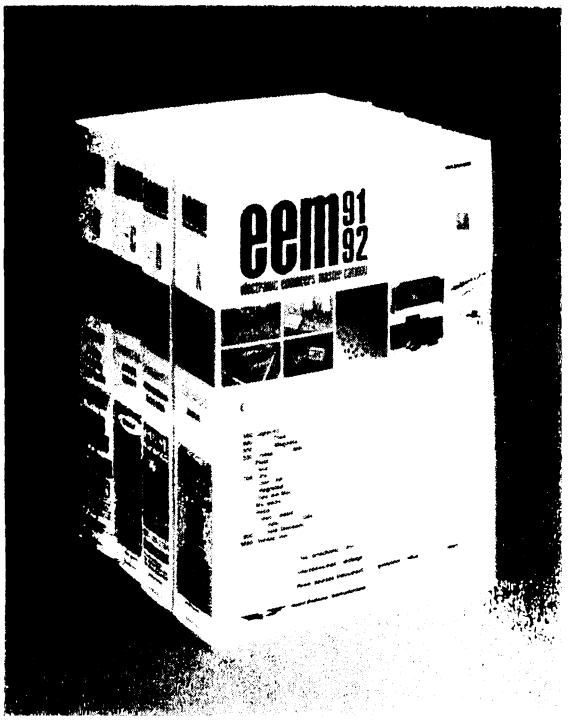

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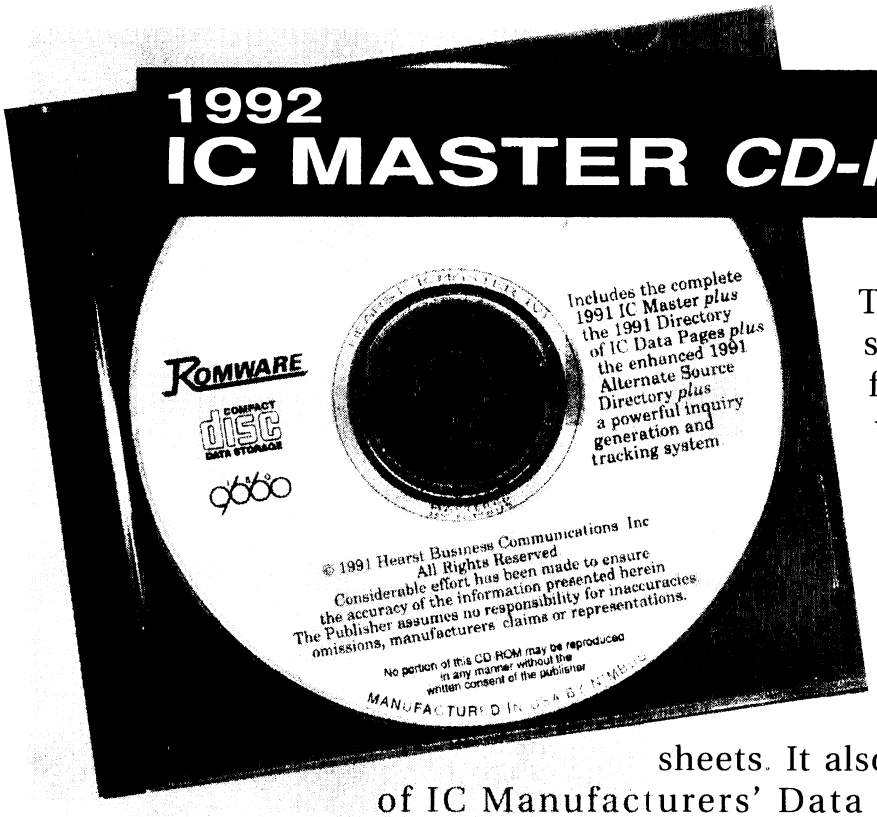
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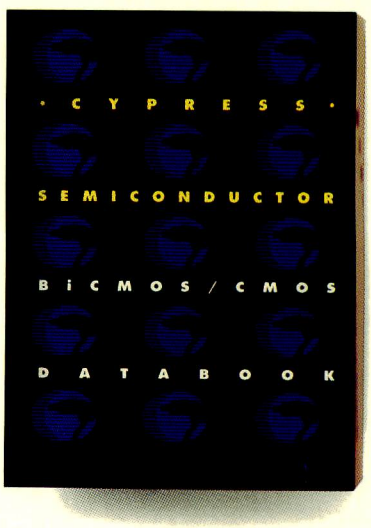

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